6 Economic Analyses

6.1 Introduction

This chapter discusses existing economic conditions, the methodology used for the economic analysis, and the projected economic effects of the flow augmentation scenarios. The major sections include:

- Agricultural Economics
- Hydropower Economics
- Recreation Economics
- Regional Economics

The economic analyses of flow augmentation scenarios measures impacts from two perspectives: (1) the Federal or national view considers the net effects to the nation and (2) the regional analysis identifies economic gains and losses to specific functional economic regions in the Snake River basin. In addition to the economic analyses, the social analysis presented in chapter 8 discusses how selected communities and groups within the regions would be affected by the scenarios.

The first perspective identifies those gains or losses at the national level. Economic gains or losses achieved by one region when offset in another region do not represent a change in the national economy. Conversely, a scenario showing less water available to irrigation, would have the potential to reduce farm income which would result in a negative effect to the national economy. Estimates of changes in the national economic value are included in the Environmental Consequences sections of this chapter, under irrigation, hydropower, and recreation.

The second perspective presents the economic consequences of the scenarios on sales, employment, and income. Regional impacts represent the change in the economy of a community or region. For example, a change in the water supply to irrigation, in addition to the direct impact to irrigated farming, may also affect those industries or sectors supplying inputs to irrigated farming located within the particular region. Regional impacts are commonly referred to as secondary, indirect, or multiplier effects, but also include the direct affect in the region being analyzed.

Impacts on agricultural and regional economics are shown by economic regions that best fit that analysis; these regions are explained within the appropriate sections. Agricultural effects to the nation are based on five irrigated agricultural regions (see figure 6-1). In contrast, regional impacts were developed by preparing a regional input-output model for four regions in the Snake River basin. The four regions are shown in figure 6-2. The regional impact analysis, including methodology and results, is presented in section 6.5 of this chapter.

Fiscal impacts, potential impacts to the receipts and expenditures of political jurisdictions, were briefly examined and are discussed but not estimated in attachment E at the end of this report.

No attempt was made to disaggregate or separately analyze the economies of the two Indian Reservations located within the area of analysis. If a large scale flow augmentation program were to be implemented, a separate analysis of tribal economic impacts would be necessary.

6.2 Agricultural Economics And Land Use

6.2.1 Affected Environment

This section describes the affected environment with respect to agricultural production in the Snake River basin. For analysis, the affected agricultural area is divided into five regions–the Northeast, Southeast, South-Central, Southwest, and Grande Ronde regions (see figure 6-1). This discussion of agricultural economic and land use focuses on the following key agricultural indicators that were used to assess potential impacts of the flow augmentation scenarios:

- Irrigated and harvested acres
- Cropping patterns and the value of agricultural production
- Cost of production and net income
- Agricultural water use and water pricing
- Farm structure and characteristics

The Base Case scenario is the existing condition. Crop acres, prices, yields, and production costs are described. Water supplies are based on the results of the hydrologic model of a simulated 62-year sequence of delivery and consumptive use given the 1990s level of agricultural water demands.

6.2.1.1 Sources of Information

Agricultural economics and land-use data from 1920 to 1995 were collected to develop an historical perspective and to describe recent trends and conditions in agricultural production and land use. The primary data sources for the discussions are:

- Idaho Crop Production Reports. These reports are published annually and are available from the 1930s to the present for some counties. They provide detailed data on harvested acreage, yield, and value of production for the principal crops produced in each county. These data are collected from county records and visual surveys. The reports record all harvested acreage (irrigated and dry land).

- U.S. Department of Commerce Census of Agriculture. These agricultural census reports provide information by county. The data include the number and size of farms, extent of farmlands, cropland acreage, irrigated acreage, types of farm ownership, market value of production, production expenses, and acreage of principal crops. The Census of Agriculture is a legally required report that is sent to each farmer in an area. The data were collected in 1964, 1969, 1978, 1987, and 1992.

- University of Idaho Cooperative Extension Service (CES) Crop Budgets. The CES has developed budgets for representative crops in many counties and regions in Idaho. These budgets can be used by farmers as guides for making production decisions and determining potential returns. The budgets are based on typical production practices for the area and are detailed and documented.

- Bureau of Reclamation AGRIMET Information Service. This service provides estimates of daily, monthly, and average annual crop consumptive use of water and precipitation by region.

6.2.1.2 Regions

The five regions which cover 31 counties in Idaho, 4 counties (Baker, Union, Wallowa, and Malheur) in Oregon, 2 counties (Lincoln and Teton) in Wyoming, and 1 county (Elko) in Nevada. Figure 6-1 shows the five regions and table 6-1 summarizes the counties included in each region.

Table 6-1 Economic Regions and County Groupings

Economic Region	Counties Included
Northeast	Clark, Custer, Fremont, Jefferson, Lemhi, Madison, and Teton in Idaho. Teton in Wyoming.
Southeast	Bannock, Bingham, Bonneville, Butte, Caribou, and Power in Idaho. Lincoln in Wyoming.
South-Central	Blaine, Camas, Cassia, Gooding, Jerome, Lincoln, Minidoka, and Twin Falls in Idaho.
Southwest	Ada, Adams, Boise, Canyon, Elmore, Gem, Owyhee, Payette, Valley, and Washington in Idaho. Malheur in Oregon. Elko in Nevada
Grande Ronde	Baker, Union, and Wallowa in Oregon.

6.2.1.3 Historical Perspective

Idaho has been predominantly rural from the time it was a territory until the 1960s and 1970s. The economy has been based on agriculture, timber, and mining, with agriculture providing the stable base. Although manufacturing, services, and other sectors began challenging the lead role of agriculture in the 1970s, Idaho remains an agricultural state. Eastern Oregon is also rural with an economy based primarily on agriculture, including livestock, food processing, and timber.

Agriculture, and the related infrastructure, is heavily influenced by the irrigation of land along the crescent of the Snake River and its tributaries in southern Idaho and southeast Oregon. Nearly two-thirds of Idaho's farm land is located in this crescent. Irrigation is generally essential to intensive agriculture in this area due to the high summer temperatures and the lack of rainfall during much of the growing season.

The discovery of gold in the 1860s spurred the irrigation of the Boise Valley to provide food for miners and those employed in supporting businesses. By 1865, most of the river bottom land in the Boise Valley was under irrigation. Mining booms in other parts of southern Idaho led to similar developments of irrigated agriculture.

Irrigated agriculture in Idaho was initiated as private developments by diversion of the natural flow of surface waters. When this resource was fully appropriated, further irrigation required development of storage and delivery systems. All significant storage for irrigation in Idaho and eastern Oregon was developed through Federal projects. Irrigation water from federally developed storage is controlled by contracts with the Federal Government. Private irrigation was also developed based on groundwater pumping, including supplementing natural flows with groundwater. Irrigated acres in Idaho can be traced from about 217,000 in 1890 to about 3,260,000 acres as reported in the 1992 Census of Agriculture.

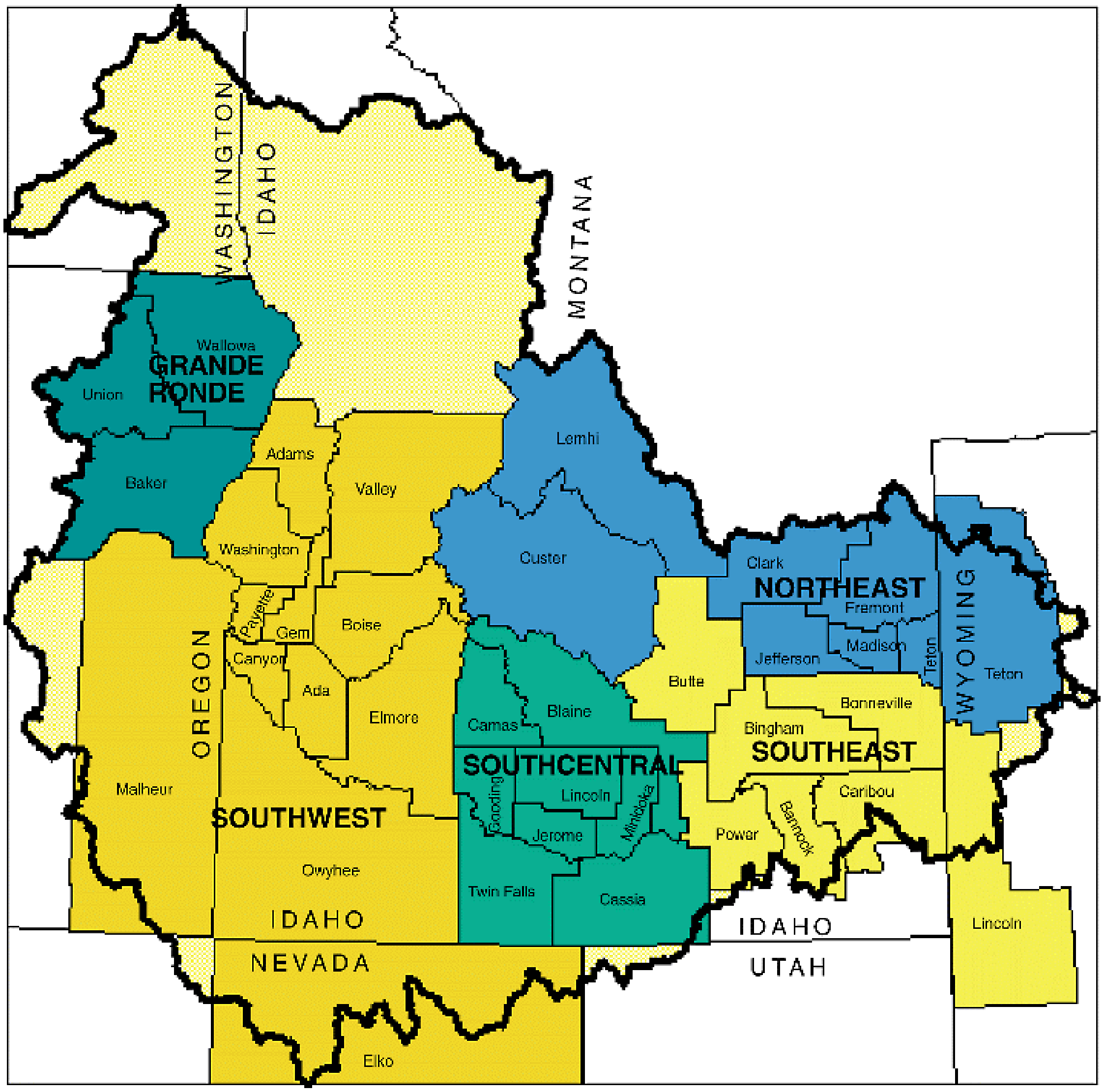
6.2.1.4 Crop Categories

Data on crop acreage, yield, price, and production cost for the basin were collected and grouped into crop categories as shown in table 6-2.

Table 6-2 Crop Categories	
Crop Category	Main Crops
Alfalfa	Alfalfa hay, other hay
Pasture	Irrigated pasture
Potatoes	Chipping potatoes, russet burbank potatoes
Wheat	Soft white spring wheat, soft white winter wheat, hard red spring wheat
Barley	Barley
Corn	Field corn, silage corn
Beans	Dry beans
Oats	Oats
Sugar Beets	Sugar beets
Specialty Crops	Onions, peppermint, spearmint, sweet corn, vegetable seed
Orchards	Apples, cherries, apricots, peaches, grapes

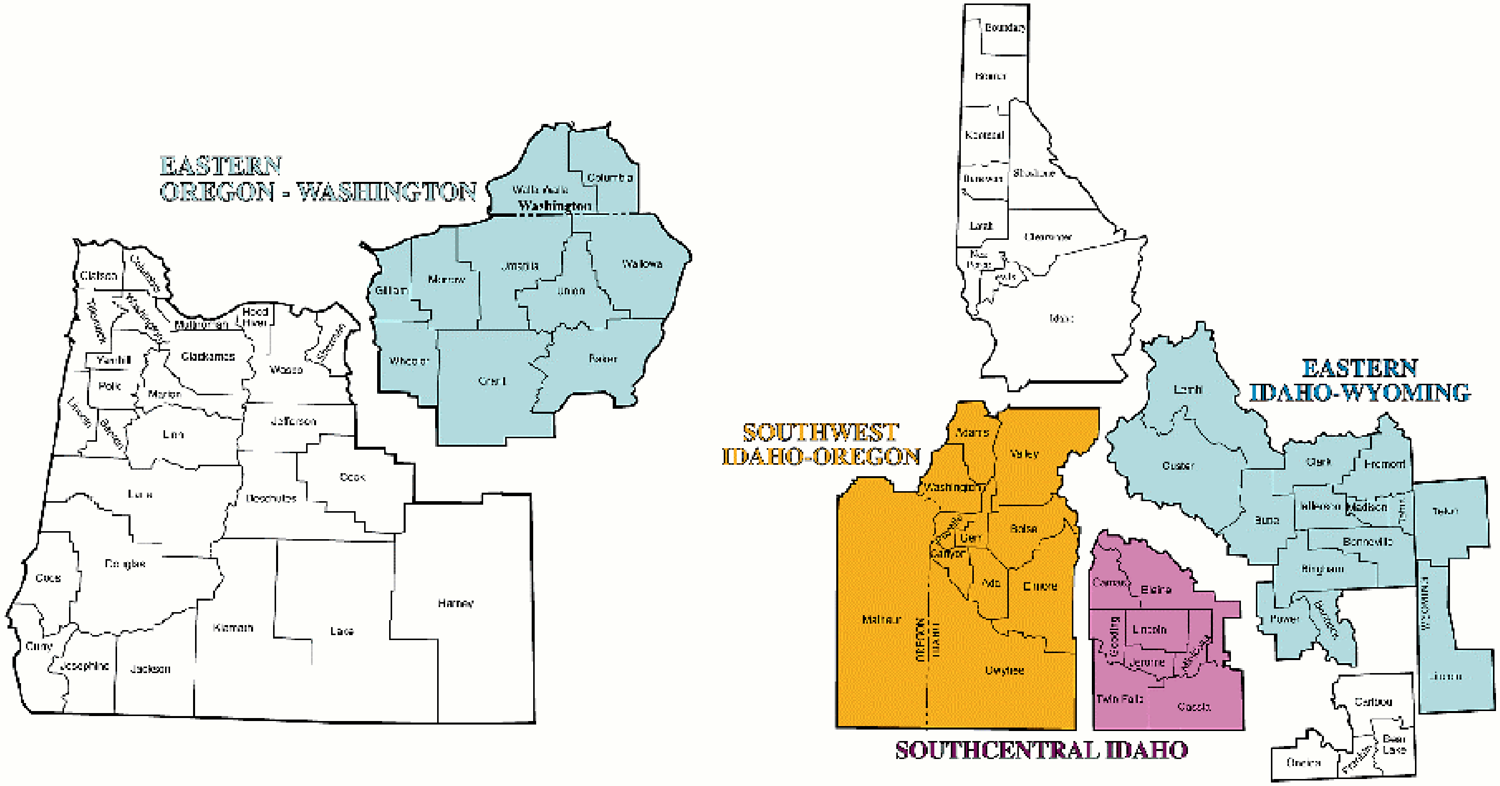
6.2.1.5 Agricultural Water Use

Table 6-3 presents the average annual consumptive use of irrigation water for the Snake River basin between 1993 and 1996 and is arranged by crops for the five economic regions. Total water use in a region is determined by irrigated acreage and the crop mix. Water usage was greatest in the South-Central region (more than 2 MAF), followed by the Southwest region (more than 1.6 MAF). The Northeast and Southeast region each used more than 1.2 MAF of water per year. Total average annual consumptive water use for all five regions was nearly 6.7 MAF.



Irrigated Agriculture Economic Regions Within the Snake River Basin	
Economic Region	Counties
Northeast	Clark, Custer, Fremont, Jefferson, Lemhi, Madison, and Teton in Idaho; Teton in Wyoming.
Southeast	Bannock, Bingham, Bonneville, Butte, Caribou, and Power in Idaho; Lincoln in Wyoming.
South-Central	Blaine, Camas, Cassia, Gooding, Jerome, Lincoln, Minidoka, and Twin Falls in Idaho.
Southwest	Ada, Adams, Boise, Canyon, Elmore, Gem, Owyhee, Payette, Valley, and Washington in Idaho; Malheur in Oregon; Elko in Nevada.
Grande Ronde	Baker, Union, and Wallowa in Oregon.

FIGURE 6-1



MAF - Functional Economic Impact Regions

Figure 6-2

Table 6-3 Average Annual Consumptive Use of Irrigation Water for 1993-1996 (Acre-Feet)						
Crop Category	Northeast	Southeast	South-Central	Southwest	Grande Ronde	Total
Alfalfa	456,000	331,000	601,000	466,000	283,000	2,137,000
Pasture	246,000	134,000	269,000	426,000	188,000	1,263,000
Potatoes	161,000	228,000	182,000	54,000	0	625,000
Wheat	144,000	365,000	332,000	208,000	36,000	1,085,000
Barley	210,000	186,000	208,000	64,000	18,000	686,000
Corn-grain	0	0	26,000	64,000	0	90,000
Corn-silage	5,000	2,000	50,000	55,000	0	112,000
Dry Beans	0	0	115,000	37,000	0	152,000
Oats	7,000	9,000	7,000	8,000	1,000	32,000
Sugar Beets	0	36,000	230,000	139,000	0	405,000
Specialty Crops	0	0	0	87,000	0	87,000
Orchards	0	0	0	14,000	1,000	15,000
Total	1,229,000	1,291,000	2,020,000	1,622,000	527,000	6,689,000
Source: AGRIMET Information Service. AGRIMET provides total evapotranspiration use by crops. The numbers reported in this table are the total minus the effective precipitation.						

6.2.1.6 Irrigated And Dry Land Crop Acreage

Table 6-4 shows irrigated and dry land crop acreage by regions from 1988 through 1995, excluding pasture.

Table 6-4 Irrigated and Dry Land Acreage (1988-1995)[1]									
Economic Region	1988	1989	1990	1991	1992	1993	1994	1995	Average
Northeast									
Irrigated (acres)	580,000	607,000	604,000	637,000	651,000	629,000	635,000	623,000	621,000
Dry land (acres)	117,000	138,000	129,000	123,000	120,000	119,000	101,000	103,000	119,000
Percent irrigated	83	81	82	84	84	84	86	86	84
Southeast									
Irrigated (acres)	736,000	797,000	798,000	837,000	820,000	813,000	813,000	825,000	805,000
Dry land (acres)	411,000	421,000	375,000	305,000	296,000	340,000	350,000	357,000	357,000
Percent irrigated	64	65	68	73	73	71	70	70	69
South-Central									
Irrigated (acres)	824,000	921,000	964,000	928,000	944,000	990,000	1,003,000	1,006,000	947,000
Dry land (acres)	86,000	82,000	84,000	83,000	63,000	91,000	82,000	82,000	82,000
Percent irrigated	91	92	92	92	94	92	92	92	92
Southwest									
Irrigated (acres)	529,000	597,000	585,000	583,000	558,000	621,000	567,000	546,000	573,000
Dry land (acres)	36,000	46,000	41,000	37,000	30,000	48,000	34,000	36,000	39,000
Percent irrigated	94	93	93	94	95	93	94	94	94
Grande Ronde									
Irrigated (acres)	**Not Available**								
Dry land (acres)									
Percent irrigated									

Source: Idaho, Wyoming, and Oregon Agricultural Statistics.
[1] Does not include irrigated and dry land pasture.

Table 6-4 indicates that the crop acreages and the percent irrigated remained fairly stable in each of the five regions over the 1988-1995 period. Slightly lower irrigated acreage during the first part of the period is probably the result of drought during between 1987 and 1992. Irrigation acreage accounts for a considerably higher percentage of agriculture land in the South-Central and Southwest regions than in the other three regions.

6.2.1.7 Cropping Patterns And Production Value

The cropping pattern is the share of acres planted to individual crops or categories of crops within a region. Table 6-5 summarizes the average irrigated-harvested acres, and table 6-6 summarizes gross production value between 1988 and 1995 by crop categories for the five economic regions. Estimates in these tables include irrigated pasture data from the Census of Agriculture.

Table 6-5 Average Irrigated-Harvested Acres (1988-1995)						
Crop Category	Northeast	Southeast	South-Central	Southwest	Grande Ronde	Total
Alfalfa	197,000	137,000	227,000	154,000	94,000	809,000
Pasture[1]	106,000	55,000	102,000	141,000	62,000	466,000
Potatoes	109,000	149,000	102,000	29,000	0	389,000
Wheat	105,000	254,000	224,000	129,000	23,000	735,000
Barley	144,000	121,000	136,000	44,000	12,000	457,000
Corn-grain	0	0	14,000	35,000	0	49,000
Corn-silage	3,000	1,000	28,000	30,000	0	62,000
Dry edible beans	0	0	103,000	28,000	0	131,000
Oats	5,000	6,000	4,000	6,000	0	21,000
Sugar beets	0	19,000	109,000	63,000	0	191,000
Specialty crops	0	0	0	46,000	0	46,000
Orchards	0	0	0	8,000	0	8,000
Total	669,000	742,000	1,049,000	713,000	191,000	3,364,000

Source: Idaho, Wyoming, and Oregon Agricultural Statistics; Census of Agriculture for 1987 and 1992.
[1]Irrigated pasture estimates from Census of Agriculture.

Table 6-6 Gross Production Value for 1988-1995 (Thousand Dollars)						
Crop Category	Northeast	Southeast	South-Central	Southwest	Grande Ronde	Total
Alfalfa	65,878	64,243	88,971	64,399	39,197	322,688
Pasture[1]	28,759	17,493	45,871	89,056	40,682	221,861
Potatoes	159,081	226,719	200,850	67,329	0	653,979
Wheat	30,813	85,017	78,532	46,896	8,220	249,478
Barley	29,703	28,787	32,276	9,968	2,773	103,507
Corn-grain	0	77	4,441	11,327	0	15,845
Corn-silage	1,329	1,056	14,211	16,645	0	33,241
Dry Edible Beans	0	0	43,816	12,685	0	56,501
Oats	618	743	539	726	61	2,687
Sugar Beets	0	19,108	102,089	71,097	0	192,294
Special Crops	0	0	0	135,392	0	135,392
Orchards	0	0	808	30,412	1,866	33,086
Total	316,181	443,243	612,404	555,932	92,799	2,020,529

Source: Idaho, Wyoming, and Oregon Agricultural Statistics; Census of Agriculture for 1987 and 1992.
[1]Irrigated pasture acreage estimates are from Census of Agriculture. Value per acre is estimated as the equivalent forage value of alfalfa hay/

There is considerable variation in cropping pattern and gross production value among the regions. On the basis of crop acreage, alfalfa is a major crop in all regions, as is pasture in all regions except the Southeast. Potatoes are a major crop in all regions except for the Southwest and the Grande Ronde, while wheat is a major crop in all but the Grande Ronde region. Sugar beets are found in the Southeast, South-Central, and Southwest regions while specialty crops and orchards are confined to the Southwest.

On the basis of gross crop production value, the Southeast, South-Central, and Southwest regions are the major producers. The crop with the greatest production value is potatoes followed by sugar beets; however, potato production is not found in the Grande Ronde region, and sugar beet production is a major source only in the South-Central and Southwest regions.

Alfalfa and pasture are the most important crops only in the Grande Ronde region. It should be recognized that in all regions, pasture, hay, and alfalfa are often marketed through livestock production. The complementary relationship between forage production and livestock enhances the total income.

6.2.1.8 Farm Structure

The number and size of farms and ownership patterns describe the general structure of agriculture within a region. Table 6-7 summarizes the number of farms, farm sizes, and farm ownership for the five regions for 1987 and 1992.

Table 6-7 Farm Structure for 1987 and 1992

Region/Year	Farms			Ownerships		
	Farms (Number)	Acres	Average Size (Acres)	Full Owner	Partnership	Tenant
Northeast						
1987	3,514	2,465,000	701	2,146	1,062	306
1992	3,321	2,289,000	689	1,939	1,048	334
Southeast						
1987	5,478	4,273,000	780	3,251	1,670	557
1992	4,856	4,101,000	844	2,861	1,532	463
South-Central						
1987	5,621	2,423,000	431	3,316	1,435	870
1992	5,133	2,324,000	453	2,923	1,432	778
Southwest						
1987	8,128	5,162,000	635	5,019	2,121	988
1992	7,663	5,068,000	661	4,688	2,127	848
Grande Ronde						
1987	1,843	2,038,000	1,106	1,108	564	171
1992	1,803	1,986,000	1,102	1,089	629	185

Sources: Census of Agriculture data for 1987 and 1992.

Between 1987 and 1992, the total number of acres in farms and the number of farms declined in all regions, due largely to urbanization and industrial use. Along with the decline in the number of farms, full ownerships declined in all regions, while partnerships tended to remain stable. Tenant farmers decreased in the Southeast, South-Central, and Southwest regions but increased in the other two regions.

6.2.1.9 Irrigation Methods and Land Value

The two primary irrigation methods used in the regions are surface gravity irrigation and sprinkler irrigation as shown on table 6-8.

Table 6-8 Method of Irrigation and Land Value

Region	Irrigated Acreage[1] (Acres)			Percentage of Irrigated Acreage		Average Land Value ($/Acre)
	Surface	Sprinkler	Total	Surface	Sprinkler	
Northeast	174,000	496,000	670,000	26	74	562
Southeast	193,000	550,000	743,000	26	74	578
South-Central	357,000	692,000	1,049,000	34	66	885
Southwest	392,000	320,000	712,000	55	45	598
Grande Ronde	106,000	86,000	192,000	55	45	382

[1]Includes irrigated pasture data from the Census of Agriculture.
Source: Census of Agriculture, 1994; Idaho Food and Agriculture, 1996.

Sprinkler irrigation dominates the Northeast, Southeast and South-Central regions while lands in the Southwest and Grande Ronde regions are about equally sprinkler and surface water irrigated. The average land value varies from $382 per acre in the Grande Ronde region to $885 per acre in South-Central region. The value of land is determined by location, the suitability for irrigation, and the ability to grow relatively high-value crops.

6.2.1.10 Agricultural Production Costs And Net Revenues

Net returns are determined by subtracting costs from revenue. Higher costs reduce farm profits, but some costs also represent farm expenditures in the regional economy. Table 6-9 presents farm income and production expenses for the five economic regions for 1987 and 1992.

From 1987 to 1992, the value of crop production increased in all regions and the value of livestock increased in all regions except the Grande Ronde. Other revenue decreased in all regions primarily due to decreased government payments. In total, farm income increased in all regions except the Grande Ronde where it remained about the same.

Total production costs increased in all regions. The only production costs which did not increase in all regions were fertilizer and chemical costs and livestock related costs. Fertilizer and chemical costs decreased in the Southwest region, remained stable in the Grande Ronde region, and increased substantially in the other three regions. Livestock related costs remained essentially unchanged in the Northeast and Grande Ronde regions, decreased in the Southwest, and rose substantially in the other two regions. Hired and contract labor increased substantially in all regions as did other costs.

The percent change in net cash return during the period from 1987 to 1992 was positive for four regions and ranged from about 39 percent increase for the Northeast region to a 3 percent increase in the Southwest; the Grande Ronde region suffered a 26 percent decrease in net cash return.

Table 6-9 Total Farm Income and Production Expenses for 1987 And 1992 (Million Dollars)										
Region/Year	Total Farm Income				Total Production Expenses					Net Cash Return
	Value of Crop Production	Value of Livestock	Other Revenue[1]	Total	Livestock Related	Fertilizer and Chemicals	Hired and Contract Labor	Other[2]	Total	
Northeast										
1987	144	136	17	297	57	29	26	119	231	66
1992	233	141	7	381	58	43	40	154	295	86
Southeast										
1987	267	169	43	479	69	55	42	192	358	121
1992	368	202	25	595	95	68	51	232	446	149
South-Central										
1987	323	393	33	749	207	56	68	239	570	179
1992	461	570	14	1,045	348	74	94	328	844	201
Southwest										
1987	323	564	18	905	355	77	82	217	731	174
1992	407	681	10	1,098	334	73	105	407	919	179
Grande Ronde										
1987	28	82	7	117	34	10	7	39	90	27
1992	32	81	2	115	32	10	9	44	95	20

Sources: Census of Agriculture, 1987 and 1992.

[1] Other revenue is in addition to the agriculture product value and included government payments, direct sales, custom work, and other farm services.

[2] Includes payment for family labor, management, returns to land and water, risk, and other uncounted costs of farming.

6.2.1.11 Aquaculture

Aquaculture is the growing and harvesting of fish for commercial sale and restocking. The Idaho aquaculture industry is the third largest animal product industry in the State. Sale of fresh-market and processed trout is by far the largest segment of the aquaculture industry. In 1991, Idaho produced an estimated 40 million pounds or about 65 percent of the Nation's processed trout. Annual value of production was estimated at $60 million at that time with the industry directly employing from 750-900 people.

Trout production requires a reliable source of cool, good-quality water. The natural spring flows in the Twin Falls/Buhl area (South-Central region) and the American Falls/Pocatello area (southeast region) are ideal to meet this need. IDWR estimates that about 40 percent of the spring flow in this reach of the Snake River is diverted for use in fish production. Very little of this water is used consumptively and most flows back into the Snake River. This industry relies on natural aquifer recharge and recharge from upstream irrigation diversions for its continued water supply.

6.2.2 Environmental Consequences

6.2.2.1 Introduction

This section describes the assumptions, methods, and results of the analysis of flow augmentation and is limited to the direct impacts on irrigation. Analysis of agricultural impacts is closely coordinated with hydrologic analysis because the direct cause of agricultural changes in this study are changes in water delivery. Details of this coordination are described in Methods and Assumptions below. Key measurement variables used to assess agricultural production impacts are: irrigated land use, crop water use, and value of irrigated production (gross revenue of products sold). Other economic measures such as net return, risk and financial effects, and land values are briefly discussed.

Results from the agricultural impacts analysis form an important part of the analysis of regional economic impacts. Changes in direct production in the agricultural sector affect many related sectors of the economy including livestock, food processing, materials and equipment sales, and trucking. Changes in regional income and employment that take account of all related sectors are described in the Regional Economics section. Social implications of changes in income and employment patterns are discussed in chapter 8.

6.2.2.2 Methods and Assumptions

The estimate of agricultural impacts is based on the water supply impacts that are described in chapter 5. As indicated in chapter 3, improvement in carriage system and onfarm efficiency do not provide additional water at the lower end of the basin. Therefore, this analysis assumes consumptive use of irrigation water must be reduced by fallowing some existing irrigated land.

6.2.2.2.1 Willing Seller Assumptions

The mechanism for obtaining water for flow augmentation has a substantial effect on agriculture. If water were reallocated from junior water right holders, shortages would be imposed on existing users according to water rights priorities. Lands and crops affected by water shortage would be largely determined by the kinds and location of land served by different water rights. Alternatively, if water were purchased from willing sellers, economic principles suggest that lower quality land and less profitable crops would be affected. In a willing-seller market, water would tend to be purchased in locations with crop patterns that cost the least, in terms of foregone crop revenue. This analysis assumes that water for flow augmentation is purchased from willing sellers.

6.2.2.2.2 Crop Reduction Methods

Three approaches to reducing crops with a reduced water supply were identified:

- Least-cost reduction of crops–crops are fallowed in order of increasing net revenue per acre.
- Modified proportional reduction of crops–high profit specialty crops, potatoes, sugarbeets, orchards, and vineyards would be relatively unaffected and cut backs would focus on grains, forages, and other field crops.
- Strict proportional reduction of crops–all crops, not just field crops, would be reduced proportionately to the reduced water supply.

After considering the issue, Reclamation adopted the modified proportional approach for analysis of both direct and regional effects. This does not discount the possibility that a specific flow augmentation program might result in other patterns of crop reduction. If flow augmentation in the range analyzed here were adopted, care would need to be exercised in implementation to assure that water purchases would not exacerbate economic impacts. To show the possible range of impacts on agriculture, all three crop reduction approaches were calculated to show direct effects on agriculture.

The decision to use the modified proportional reduction has been controversial. The economic theory view is that farmers would optimize their income in the event of a water shortage by reducing the lowest value crops first. However, discussions with potentially affected water users reveal that they have a very different view. Their view is that the uncertainties associated with a reduced water supply would cause farmers to avoid high profit crops which involve greater risk because they require late season water and cost more to establish and nurture. A failure of a high valued crop such as potatoes or beets would create more severe economic problems for a farmer than a failure of a lower valued crop. In addition, some low value crops such as small grains do not require a late season water supply. Water users suggest that these factors would lead irrigators to plant low risk, low profit crops and to avoid high risk crops such as potatoes and beets.

This method of reducing water usage in this analysis is of particular concern since significant volumes of storage space are included in the 1427i and 1427r scenarios. Stored water is typically diverted for use later in the irrigation season after natural flows recede. Some of the reservoir storage serves as "insurance" water supply in case of a drought. Many of the most valuable crops grown in Idaho, including potatoes, orchards, and other specialty crops, require a reliable supply of water during the late-summer irrigation season. Natural flow rights generally can be relied on to supply water throughout the spring and early summer. Water released from storage during the late summer and fall provides the insurance growers need to reduce the risk of planting high-valued, high-cost crops. Figure 6-3 shows the monthly consumptive use pattern of major crops in the South-Central region and illustrates the need for a reliable, late-season irrigation supply for some crops.

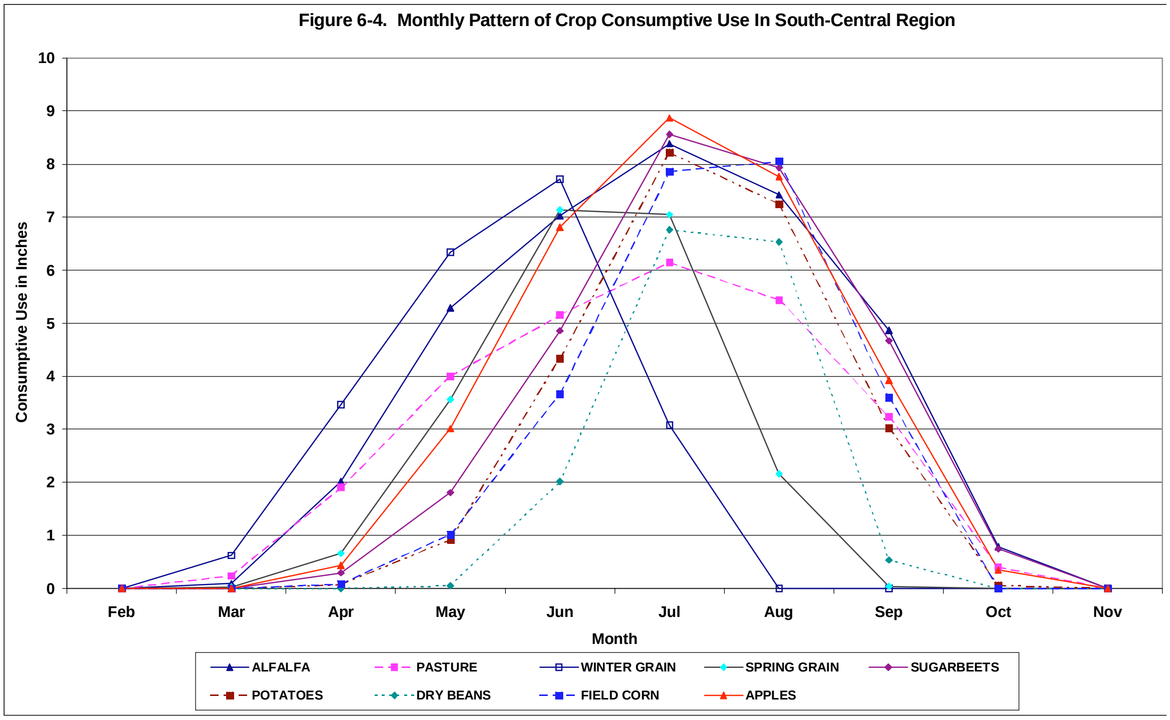


Figure 6-3 Monthly Pattern of Crop Consumptive Use in the South-Central Region

If a water acquisition program were implemented in a way that disproportionately reduces late-season water supply, the impact on crops requiring late-summer irrigation would be magnified and economic impacts, both direct and secondary, could be severe. Acquiring only storage rights would increase the likelihood of a late-summer water shortage and impose significant risk for crops requiring late-season irrigation. Because of the willing-seller assumption, the cost to implement such a program would also be extremely high. Rough estimates suggest that this type of acquisition program could have a direct impact on the value of irrigated production that could be almost twice as great as for the modified proportional approach.

6.2.2.2.3 Crop Consumptive Use and Estimated Crop Reduction

The number of acres taken out of production and the consumptive use changes associated with natural flow rights are summarized in chapter 5 (table 5-2). The hydrologic analysis also identifies irrigation shortages from storage supplies for average years, a dry year, and a wet year (see tables 5-11, 5-12, and 5-13) for four of the five economic regions (Reclamation storage water is not used in the Grande Ronde economic region). Irrigation shortages were then converted to consumptive use changes based on returnflow fraction used in MODSIM. For agricultural diversions, consumptive use comprises crop evapotranspiration of applied water (ETAW), canal and other water surface evaporation, and water consumptively used by stream-side and canal-side vegetation. For purposes of this analysis, it was assumed that these last two categories of water use do not change significantly among the scenarios, i.e., canals would still have water in them so evaporation and canal-side vegetation use would occur at the same rate under all scenarios.

After computing the estimated reduction in consumptive use, the portion of consumptive use that is met from applied irrigation water is calculated. Consumptive use is met by irrigation water (ETAW) and effective precipitation (EP). EP is defined as the amount of precipitation that is consumptively used by crops and was estimated using a procedure that accounts for monthly precipitation. Total consumptive use minus EP equals ETAW, which is the set of numbers (by crop and by region) used to allocate changes in crop acreage that would result from a reduced water supply.

The decrease in ETAW is allocated among the crops using the three crop reduction approaches described previously. Impacts by crop and region were summarized, showing changes in irrigated acres, gross revenue (i.e., value of production), and net revenue. Direct gross revenue changes to agriculture are used in the Regional Economic analysis to estimate total regional impacts on value of output, income, and employment.

Results are summarized for average water supply, defined as annual average over the 1928-1989 hydrologic record and for a dry-year, 1977.

6.2.2.2.4 Prices, Yields, and Costs

All estimates of prices, yields, and costs are based on recent information, and impacts are estimated on an annual basis for average and dry water supply conditions. Historically, crop yields have tended to rise and real prices fall; whether or not this trend will continue is speculative. No attempt was made to forecast future crop prices, yields, and production costs.

6.2.2.2.5 Irrigated Land and Water Use

Total impact on irrigated land and water use includes the lands idled by natural flow and storage purchases. The mix of crops idled will be determined by market forces, institutional restrictions, and physical conditions (including land productivity and district operational rules). Because the interaction of these factors is difficult to assess prior to more specific program information, ranges of results using three crop reduction approaches are presented.

6.2.2.2.7 Value of Irrigated Production

Value of production, also called gross revenue, is measured as the total production of an irrigated crop multiplied by its market value. Reductions in the value of production provide an estimate of the total direct loss in economic activity resulting from the water acquisition program. Value per acre for irrigated pasture is estimated using the equivalent forage value of alfalfa hay.

6.2.2.2.8 Other Direct Economic Effects

Because the water acquisition program is assumed to rely on willing sellers, direct financial impacts such as changes in net returns, land value, or risk would be compensated–water users would not agree to sell water unless they believed they were being fully compensated. Economic impacts on farm workers and others who rely on the farm economy are estimated and discussed in the Regional Economics section of this chapter and the Environmental Justice section of chapter 8.

One category of growers potentially harmed financially are tenants. If the owner of land with a water allocation decided to sell some or all of that water, a tenant leasing the land may not receive compensation for the lost net return.

6.2.2.3 No Augmentation Scenario

The No Augmentation scenario would return river/reservoir operations to the pre-1991 conditions. The MODSIM results estimate no material difference in agricultural water supply from the Base Case. Consequently, it was assumed that there would be no change in agricultural economics and no economic analysis was made of the No Augmentation scenario.

6.2.2.4 1427i Scenario

Key features of this scenario include: (1) acquisition of natural flow rights serving a total of 221,500 acres of agricultural lands in the basin; (2) substantial change in reservoir operations to increase average annual basin outflow; and (3) acquisition of additional water from Reclamation storage to achieve the 1427i flow augmentation goal. The regional distribution of lands irrigated by natural flow purchases for this analysis is: 101,500 acres in the northeast and southeast regions combined, 34,000 acres in the south-central region, 49,000 acres in the southwest region, and 37,000 acres in the Grande Ronde region.

Impact estimates were summarized to reflect the modified proportional approach. Changes in regional irrigation water use, measured as a reduction in crop consumptive use of applied water, are shown in table 6-10. These changes were interpreted as net irrigation water use changes on lands served by both natural flow and storage rights. Average reduction in total crop consumptive use of applied water was estimated to be about 346,000 acre-feet per year.

Table 6-10 Average Reduction in Crop Consumptive Use of Irrigation Water by Economic Region for the 1427i Scenario (Acre-Feet)

Northeast	Southeast	South-Central	Southwest	Grande Ronde	Total
119,250	4,789	85,598	114,463	21,680	345,790

The total decrease in irrigated acreage using the modified proportional approach is estimated at 243,000 acres. The mix of crops idled would be determined by market forces, institutional restrictions, and physical conditions (including land productivity and district operational rules). Table 6-11 summarizes the range of impacts on irrigated acres estimated using the three crop reduction approaches for average water years and dry years. The different crop reduction approaches have similar estimates of total land taken out of production which range from 243,000 to 249,000 acres for an average water supply year and over 375,000 acres in a low water supply year. The three estimation methods produced virtually identical results. On average, about 7.5 percent of irrigated land in the regions would be idled; however, the effects in the southeast region, both in actual acres and percentage, would be insignificant. Because of the assumed pattern of water acquisition used for analysis, the percentage of affected land within the economic regions ranges from less than 1 percent in the southeast region to about 20 percent in the Grande Ronde region. This represents a significant change in land use within the Snake River basin.

Table 6-11 Change in Irrigated Acres by Economic Region 1427i Scenario Compared to Base Case Scenario (Thousand Acres)						
Item	Northeast	Southeast	South-Central	Southwest	Grande Ronde	Total[1]
Base Case	670	743	1,049	712	192	3,366
Average Water Supply Year						
Least Cost	-104	-3	-41	-64	-37	-249
Modified Proportional	-103	-2	-42	-58	-37	-243
Strict Proportional	-104	-3	-43	-60	-37	-247
Low Water Supply Year						
Least Cost	-115	-21	-87	-117	-37	-378
Modified Proportional	-112	-18	-108	-101	-37	-376
Strict Proportional	-113	-18	-107	-103	-37	-379
[1]Numbers may not add do to rounding.						

The information provided in table 6-11 is displayed in graphic form in figure 6-4.

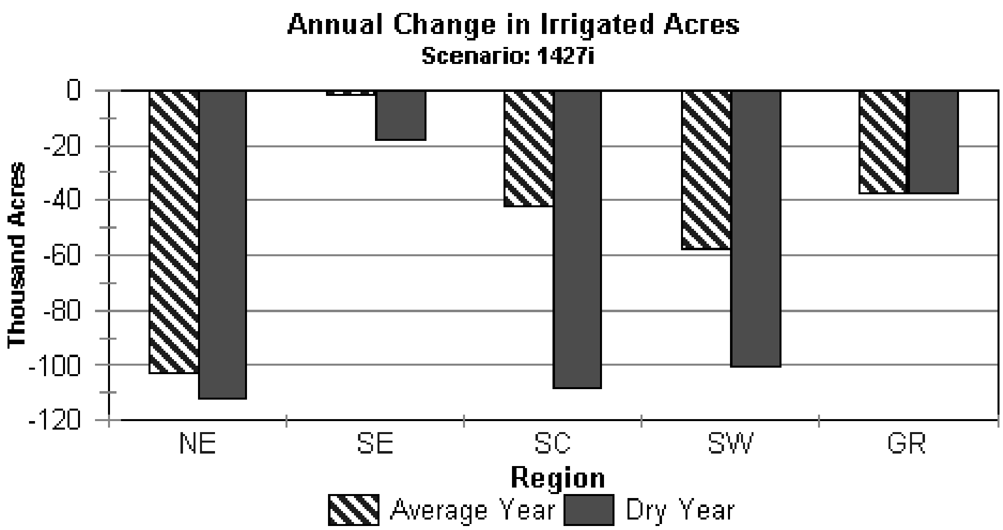


Figure 6-4 Annual Change in Irrigated Acreage Under the 1427i Scenario

Value of production, or gross revenue, was measured as the total production of an irrigated crop multiplied by its market value. Changes in value of production provided an estimate of the total direct loss in economic activity resulting from the water acquisition program. Secondary changes in economic activity, including those potentially induced by spending money received for selling water, were estimated in the Regional Economics section. Table 6-12 summarizes the range of direct impacts on value of production by region and type of water supply year.

Table 6-12 Change in Value of Irrigated Production by Economic Region–1427i Scenario Compared to Base Case Scenario (Thousand Dollars)						
Item	Northeast	Southeast	South-Central	Southwest	Grande Ronde	Total
Base Case	316,182	442,619	612,404	555,931	92,798	2,019,934
Average Water Supply Year						
Least Cost	-30524	-800	-18,032	-17,574	-12,296	-79,228
Modified Proportional	-30,548	-777	-15,568	-25,700	-17,610	-90,204
Strict Proportional	-31,227	-1,623	-25,308	-52,346	-17,610	-128,113
Low Water Supply Year						
Least Cost	-32,739	-5,012	-37,045	-40,069	-12,296	-127,160
Modified Proportional	-33,036	-6,117	-39,634	-44,805	-17,610	-141,202
Strict Proportional	-35,716	-10,948	-62,580	-85,476	-17,610	-212,330

The three crop reduction approaches produce substantially different estimates of impact on the value of production in some regions. The type of crops differs more in the value of production per acre than in the amount of water use per acre, so different mixes of crops idled result in larger variations in gross revenue. For an average water supply year, the reduction in gross revenue would range from $80 million to more than $128 million, depending on how the mix of crops was estimated. Impacts could be even greater for a crop mix that requires late-season irrigation. In the low water supply year, gross revenue was estimated to decline by $127 to $212 million per year relative to the base case scenario.

For the northeast and the Grande Ronde regions, there is virtually no difference in the estimated value of production among the three methods used and there is essentially no difference between average years and dry years.

Figure 6-5 displays the average annual impacts on value of production by region using the modified proportional method of crop reduction.

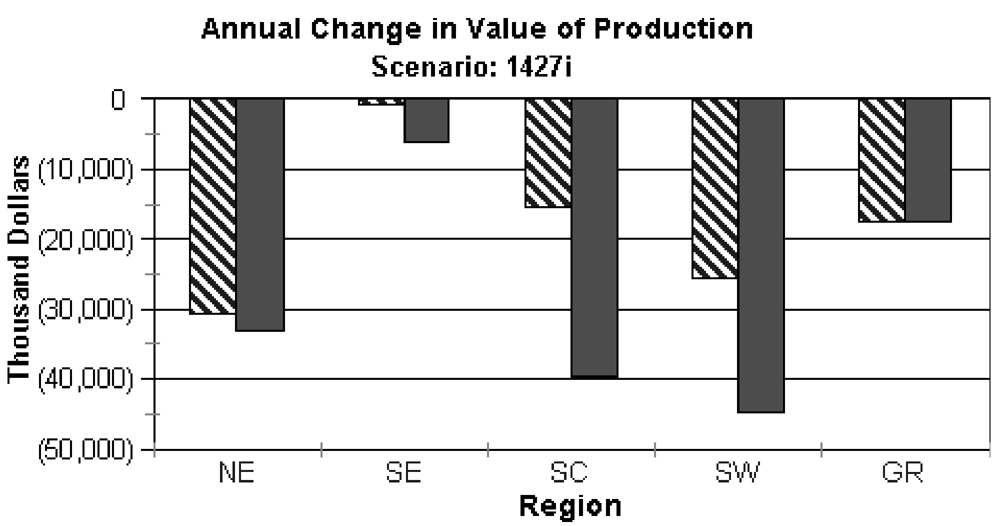


Figure 6-5 Annual Change in value of Production Under the 1427i Scenario

6.2.2.5 1427r Scenario

Key features of this scenario include: (1) acquisition of natural flow rights serving a total of 221,500 acres of agricultural lands in the basin, (2) substantial acquisition of storage water, and (3) change in reservoir operations to achieve the 1427r flow augmentation goal.

Impact estimates were summarized to reflect the modified proportional approach. Changes in regional irrigation water use, measured as a reduction in crop consumptive use of applied water, are shown on table 6-13. These changes were interpreted as net irrigation water use changes on lands served by both natural flow and storage rights. The average reduction in total crop consumptive use of applied water was estimated to be about 622,000 acre-feet per year. Impacts in storage rights delivery areas in the Northeast and Southeast regions would be substantially smaller than in the South-Central and Southwest regions and smaller than the impacts shown for the 1427i scenario. This results from the modeled interactions between reservoir carryover and deliveries are based on water rights. Higher reservoir carryover resulting from changes in operations allows for greater deliveries in the southeast and northeast regions in some years, based on the way water rights deliveries were modeled in the hydrology analysis.

Table 6-13 Average Reduction in Crop Consumptive Use of Irrigation Water by Economic Region for 1427r Scenario (Acre-Feet)

Northeast	Southeast	South-Central	Southwest	Grande Ronde	Total
116,574	1,694	260,053	221,185	21,680	621,186

The average land out of production was estimated at 360,000 acres under the modified proportional approach (natural flow and storage). Total impacts on irrigated land and water use would include the lands idled by natural flow and storage purchases. The mix of crops idled would be determined by market forces, institutional restrictions, and physical conditions (including land productivity and district operational rules).

Table 6-14 summarizes the range of impacts on irrigated acres for the 1427r scenario estimated using the three crop reduction approaches. Impacts were estimated for average water supply and low water supply years and are shown as changes compared to the Base Case. The different crop reduction approaches were fairly similar in the estimates of total land removed from irrigation and ranged from 360,000 to 381,000 acres for an average water supply year and from 570,000 to 645,000 to 471,000 acres in a low water supply year. On average, this represents over 10 percent of irrigated land in the affected regions. However, the three estimation methods did not produce different results in the northeast, southeast, and Grande Ronde regions for average water years and there was little change between average water years and dry years in these regions. The percentage of affected land within regions ranges from less than 1 percent in the southeast region to about 20 percent in the Grande Ronde region. This represents a significant change in land use within the Snake River basin.

Table 6-14 Change in Irrigated Acres by Economic Region–1427r Scenario Compared to Base Case Scenario (1,000 Acres)						
Item	Northeast	Southeast	South-Central	Southwest	Grande Ronde	Total
Base Case	670	743	1,049	712	192	3,366
Average Water Supply Year						
Least Cost	-102	-1	-107	-120	-37	-368
Modified Proportional	-102	-1	-122	-98	-37	-360
Strict Proportional	-102	-1	-134	-107	-37	-381
Low Water Supply Year						
Least Cost	-114	-12	-244	-163	-37	-570
Modified Proportional	-112	-11	-323	-160	-37	-643
Strict Proportional	-112	-11	-322	-163	-37	-645

The information in table 6-14 on the modified proportional approach is displayed in figure 6-6.

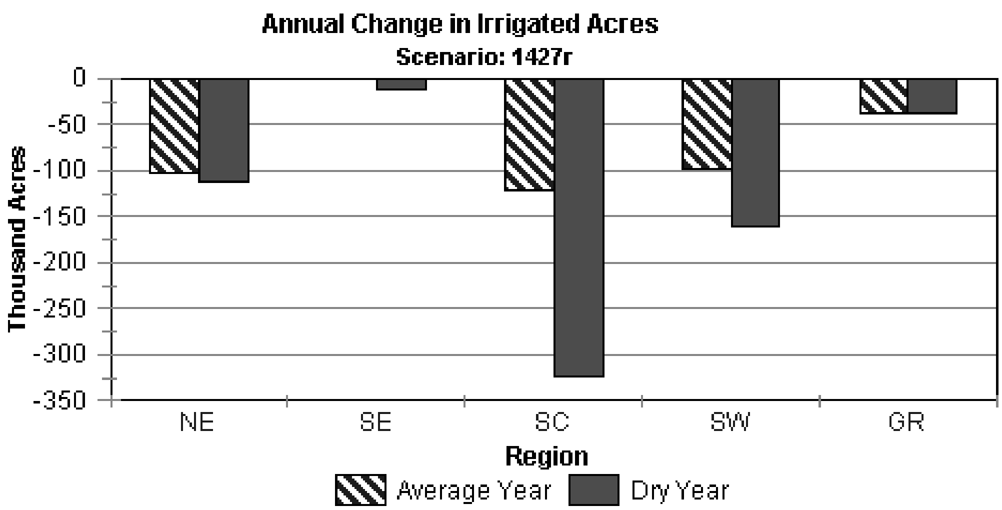


Figure 6-6 Annual Changes in Irrigated Acres Under the 1427r Scenario (Modified Proportional Approach)

Table 6-15 summarizes the range of direct impacts on value of production by region and the type of water supply year.

Table 6-15 Change in Value of Irrigated Production by Economic Region–1427r Scenario Compared to Base Case Scenario (Thousand Dollars)						
Item	Northeast	Southeast	South-Central	Southwest	Grande Ronde	Total
Base Case	316,182	442,619	612,404	555,931	92,798	2,019,934
Average Water Supply Year						
Least-Cost	-30,137	-332	-47,920	-41,920	-12,296	-132,604
Modified Proportional	-30,206	-280	-44,873	-43,464	-17,610	-136,433
Strict Proportional	-30,441	-585	-78,137	-88,476	-17,610	-215,248
Low Water Supply Year						
Least-Cost	-32,553	-3,025	-101,173	-63,632	-12,296	-212,679
Modified Proportional	-32,836	-3,658	-118,891	-70,741	-17,610	-243,737
Strict Proportional	-25,595	-6,549	-187,595	-131,857	-17,610	-369,207

For an average water supply year, gross revenue was estimated to decline by about $133 million to $216 million per year, depending on the crop reduction method. Impacts could be even greater if water were acquired primarily from storage rights which would disproportionately affect high-value crops requiring late season irrigation. In the low water supply year, gross revenue was estimated to decline by $213 million to $369 million. The three estimation methods resulted in similar estimates in the Northeast and Grande Ronde regions and resulted in similar results for average and dry years. The three methods produced different estimates for the Southeast, South-Central, and Southwest regions.

The 1427r scenario would have the greatest percentage of change in the Grande Ronde region and the least percentage of change in the Southeast region. In terms of actual dollar decreases, the South-Central and the Southwest regions would be affected the most.

The data in table 6-15 using the modified proportional approach is displayed graphically in figure 6-7.

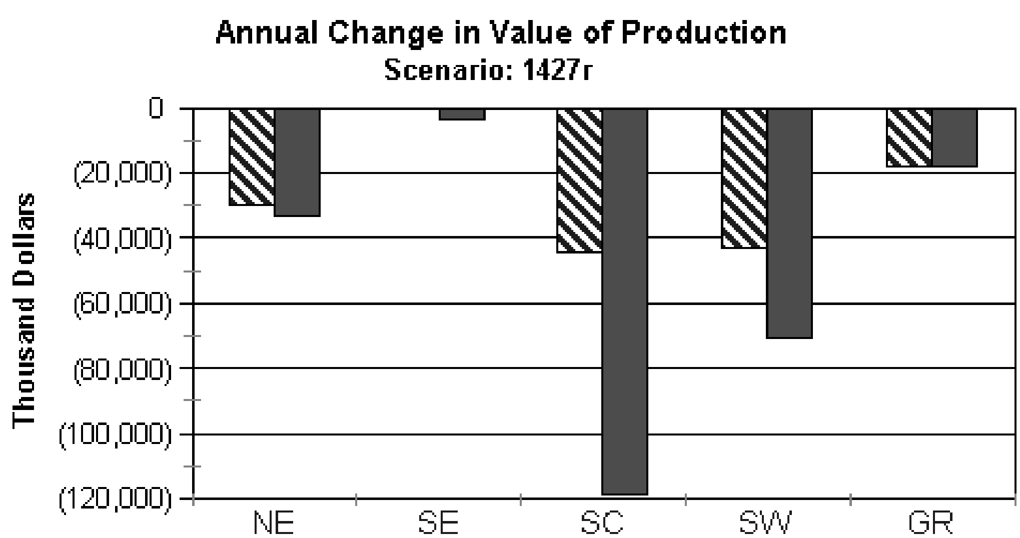


Figure 6-7 Annual Change in Value of Production Under the 1427r Scenario

6.2.2.6 National Economic Value–Irrigation

The impacts to agriculture discussed in the previous sections include an estimate of changes in gross crop revenues and acreage out of production under 1427i and 1427r in an average water year and a dry year. The change in gross crop revenue is further utilized in the regional impact analysis (using IMPLAN) to estimate regional impacts, measured as a change in regional income, sales, and employment.

For several reasons, including the fact that under the willing seller concept, water sellers would receive offsetting compensation (called a transfer payment), a traditional estimate of the net loss in farm income was not made. However, as discussed below, an estimate of reduced farm income was developed using the IMPLAN model. From a national perspective, the net loss or gain from a proposal is measured as the difference between the with and without situation utilizing traditional representative crop enterprise or farm budgets or other related techniques for measuring change in farm income. The resulting estimates of net farm income gained or lost (sometimes called the irrigation benefit or cost) are then appropriate for use in a national benefit-cost context.

Economic impacts are different from economic costs or benefits. Economic costs and benefits reflect a change to the nation as a whole (net farm income or irrigation benefits in this case), while economic impacts measure a change in the regional economy, due, in this case, to a reallocation of water resources. The change to the regional/local economy (income, sales, and employment) is the important indicator to local planners, officials, and the people who live and work in these regions.

An alternative and independent estimate of the change in economic cost to the national economy was derived by estimating "farm proprietors and other farm property income" from the IMPLAN based regional input-output model. The return to labor, land, water, and capital is included in the "income" figure. The values represent the lost returns to land, water, and agricultural capital before taxes.

Table 6-16 shows the annual income changes based on the IMPLAN regional input-output model. The estimates are shown for the four defined functional economic impact regions in the Snake River basin: Eastern Idaho-Wyoming, South-Central Idaho, Southwest Idaho-Oregon, and Eastern Oregon-Washington (also called Grande Ronde). The table shows a range of income loss for the 1427i scenario of $57.2 million annually, while the 1427r scenario shows a loss of $81.3 million annually.

Table 6-16 Annual Proprietors and Other Farm Property Income Loss by Economic Impact Region–Average Water Year (Thousand Dollars)

Region	1427i	1427r
Eastern Idaho-Wyoming	20,570	20,151
South-Central Idaho	7,076	20,397
Southwest Idaho-Wyoming	16,266	27,546
Eastern Oregon-Washington	13,263	13,263
Total[1]	57,175	81,357

[1]May not add due to rounding

6.2.2.7 Cost of Water for Acquisition

It should be noted that it is impossible to predict the market price of water if an additional 1 MAF of water were to be acquired. However, experience indicates that a significant increased demand tends to push market prices higher. There is no guarantee that any of the estimated values discussed below would reflect actual market prices.

This analysis assumes that water for flow augmentation would be acquired from willing sellers. As a result, there would be reduced farm income from reduced irrigation water use but at the same time the agricultural sector would also experience an infusion of money paid for the water acquired. Accordingly, the complete analysis of impacts on agriculture and related economic activity would include an estimate for a reasonable range of prices paid to acquire water.

Since actual acquisition cost would depend on the negotiated price from the willing seller program, three approaches to estimate the cost of acquiring water were developed to provide a range of possible costs for this analysis. The first two approaches utilize, as the starting point, the current costs for recent acquisitions in the Snake River basin while the third approach is based on estimated reduction in farm proprietor and other farm income. Acquisition costs are expressed as annual costs as well as lump sum (one time) acquisition cost.

The first approach uses recent acquisitions of permanent supplies in the Snake River basin as a basis and adjusts the amount upward to account for an expected price response. A price response to acquisition is expected because the more valuable lands and crops are affected and higher prices are demanded for selling water as water acquisition amounts increase. Water acquisition costs were put on a consumptive uses basis to be consistent with hydrologic studies which estimates consumptive use shortages for the 1427i and 1427r scenarios.

The second approach utilizes portions of the first approach but also recognizes that substantial volumes of storage space would need to be acquired to provide flow augmentation with a fairly high degree of certainty, even though the model indicates that the change in consumptive use would be relatively small for the total basin.

The third approach, which results in values between the first two reflects the IMPLAN estimates of the reduction in farm proprietor and other farm property income from the regional input-output model.

6.2.2.7.1 Estimates Based on Recent Water Acquisitions and Reductions in Consumptive Use

Recent acquisitions of reliable storage supplies in the Snake River basin have ranged between $150 and $300 per acre-foot. This represents a one-time cost for a permanent right. Applying the current Federal discount rate of 6.875 percent for water project evaluation to a project life of 100 years would result in an annual equivalent cost of $10-21 per acre-foot. Since the consumptive use fraction of water ranges from 35 percent in the eastern Snake River Plain to 50 percent in the southwest, the annual cost for water that could be used for flow augmentation would be approximately $20-60 per acre-foot.

The target amount of water to acquire for the 1427r scenario would be roughly 10 percent of total consumptive use in the basin (622,000 acre-feet of about 6.6 MAF). According to an analysis of large scale water acquisition for the Central Valley Project Improvement Act (CVPIA), acquiring 10 percent of total surface water use in the Sacramento Valley of California raised the price by about 140 percent over the base (Reclamation, 1997). Although crop mix and other conditions are different in the Snake River basin, the CVPIA experience provides a reasonable sense of how large the price effect might be when purchasing a significant portion of the irrigation water supply. Applying that price increase to the base estimate of $20-60 per acre-foot gives a range of $50-140 per year per acre-foot of consumptive use acquired. A smaller percent of irrigation water is purchased in the 1427i scenario, so an assumed price increase of 50 percent is used, resulting in a price range of $30-90 per acre foot. For purposes of analyzing the regional economic impact of money paid for water acquisition, a value of $75 per acre foot per year was used for both scenarios.

Based on the range of acquisitions cited above, the annual cost for water acquisition would range from $10.4 million to $31.2 million under the 1427i scenario and from $31.1 million to $87.2 million under the 1427r scenario. The capitalized, or lump sum, values of the annual costs would range from $151 million to $454 million for 1427i and from $452 million to $1.27 billion for 1427r. The actual acquisition cost would depend on the negotiated results from the willing seller program. Table 6-17 displays both acquisition costs by subregion in the basin for the average year situation, and the capitalized, or lump-sum, value of the estimate.

Table 6-17 Annual and Lump Sum Water Acquisition Costs Based on Recent Water Acquisitions (Average Water Year)

1427i Scenario			
Region	Water Volume (Acre-Feet)	Low Cost[1] (Dollars)	High Cost[2] (Dollars)
Northeast plus Southeast	144,110	4,323,300	12,969,900
South-Central	63,400	1,902,000	5,706,000
Southwest	90,350	2,710,500	8,131,500
Grande Ronde	49,280	1,478,400	4,435,200
Annual total	347,140	10,414,200	31,242,600
Lump-Sum Cost	--	151,283,000	453,848,000
1427r Scenario			
Region	Water Volume (Acre-Feet)	Low Cost[3](Dollars)	High Cost[4](Dollars)
Northeast plus Southeast	138,340	6,917,000	19,367,600
South-Central	237,860	11,893,000	33,300,400
Southwest	197,070	9,853,500	27,589,800
Grande Ronde	49,280	2,464,000	6,899,200
Annual total	622,550	31,127,500	87,157,000
Lump-Sum Cost	--	452,177,000	1,266,096,000

[1]$30 per acre-foot; [2]$90 per acre-foot; [3]$50 per acre-foot; [4]$140 per acre-foot

6.2.2.7.2 Estimate Based on Recent Water Acquisitions and Storage Space to be Acquired

Water acquisition consists of obtaining natural flow rights as well as storage rights. This approach recognizes the fact that although the change in consumptive use is relatively small, the amount of storage needed to control or provide the consumptive use for the storage portion for flow augmentation with a fairly high degree of certainty is significant. The water sales price estimates described above can be used to estimate the lump-sum, or one-time, payment for acquiring storage rights and natural flow diversion rights. Based on implementation assumptions made for hydrologic analysis, 1,445,000 acre feet of additional storage space is required for the 1427i scenario and 3 million acre feet of additional storage space is required for the 1427r scenario. In both scenarios, 293,640 acre feet of consumptive use water would be acquired from natural flow diverters.

For the 1427i scenario, the assumed price effect results is a 50 percent increase over the observed price range of $150-300 per acre foot. Purchasing 1,445,000 acre feet of storage rights at $225 to $450 per acre foot would require a lump-sum payment of $325-$650 million.

The 1427r scenario requires much greater storage right purchase, so the price effect was assumed to be 140 percent. Purchasing 3 million acre feet of storage at $360 to $720 per acre foot would require a lump-sum payment of $1,080 to $2,160 million. These purchases could be staged over a number of years rather than all at once, which could moderate the price effect to some degree. This approach represents the "high end" of the acquisition cost spectrum.

The lump-sum cost acquisition is summarized in the table 6-18.

Table 6-18 Lump Sum Water Acquisition Based on Cost to Acquire Storage Rights (Dollars)

Water Source	1427i		1427r	
	Low Cost	High Cost	Low Cost	High Cost
Storage Rights	325,125,000	650,000,000	1,080,000,000	2,160,000,000
Natural Flow	127,968,000	383,903,000	213,280,000	597,183,000
Total	453,093,000	1,033,903,000	1,293,280,000	2,757,183,000

6.2.2.7.3 Estimate Based on Compensating Reductions in Farm Income

Based on information in the economic model used for regional economic impact analysis, reductions in growers net income can be estimated. The regional economic impact model (IMPLAN) included an estimate of farm proprietors income and other farm property income. This estimate was used to provide an estimate of the change in net farm resulting from a loss of crop production under the 1427i and 1427r scenarios.

Using the average annual reduction in consumptive use for each scenario, the annual reduction in proprietors and other farm income of $57.2 and $81.4 million would require compensation of $130 to $165 per acre foot annually to acquire water. The lump-sum values would be $830.9 million under the 1427i scenario and $1,182 million under 1427r scenario. Annual and lump sum costs are summarized in table 6-19.

Table 6-19 Annual and Lump Sum Costs of Water Acquisition Based on Compensating Reductions in Farm Income

Cost	1427i	1427r
Annual	$57,200,000	$81,400,000
Lump Sum	$830,922,000	$1,182,446,000

6.2.2.7.4 Other Acquisition Cost Considerations

The three cost estimates described in the previous sections account for water revenue that would be received by sellers, but do not account for transaction costs that would be incurred by the buyer (Federal

Government) and possibly by other involved entities including the states, irrigation districts, and others. Transaction costs are discussed in the following section, while other implementation issues are discussed in Chapter 9.

6.2.2.8 Transaction Costs

In addition to the water acquisition cost, which is income paid to the water seller, there are other potential costs associated with implementation that may be borne by Federal or state governments or by private interests.

The potential measures where additional expenditures may be required include, but are not limited to: (1) water right identification, change of use, and monitoring; (2) negotiation, contracting, and legal costs for purchases and leases of water; (3) revegetation costs for lands no longer irrigated; (4) in lieu irrigation district operation and maintenance charges and property taxes; (5) erosion, weed, and insect control on idled lands; (6) environmental compliance requirements prior to water sale and lease; (7) mitigation costs for environmental impacts; (8) new water measurement/control facilities; and (9) other potential cost items.

Some of the above measures would be the responsibility of the landowner selling the water and essentially included in the negotiated price agreed to by the seller. Applicability and cost for some measures would vary by region or by the size of the acquisition. For example, revegetation would probably not be required in the "high elevation" pasture/hay situations. These areas would continue to be in hay and pasture and due to runoff would remain "green " in the spring. Summer and fall production would be reduced, however.

Transaction costs are difficult to identify and quantify given a water acquisition program that has not been implemented before on a scale equivalent to the assumptions made for this study. The only other resource retirement programs even closely analogous to a program of this magnitude would be the Dairy Buyout Program and the Conservation Reserve Program (CRP). The CRP currently has approximately 700,000 acres enrolled in Idaho under the CRP; landowners receive annual payments for placing land in non-commercial agricultural conditions. At the time of initial enrollment, landowners were eligible to receive up to one-half the cost to establish ground cover.

The estimated transaction costs are approximations of the potential costs based on the previously mentioned list of measures. It would be expected that certain economies of size would prevail, especially in the areas of legal, negotiation, water right identification, and administration cost. Transaction costs would be concentrated as up-front costs in the years when specific water acquisitions were completed. As the program became better known and developed, costs per unit of water would likely decline. After full acquisition, program costs would remain for administration and monitoring.

An estimate was made of potential annual transaction costs for the 1427i and 1427r scenarios. Transaction costs were developed assuming certain measures for the areas under consideration and a percentage of annual acquisition cost; an estimate of about 23 percent of acquisition costs for the estimate based on recent water acquisitions was used. Accordingly, annual transaction costs were estimated at \$2.4 million to \$7.3 million for 1427i scenarios and \$7.3 million to \$20.5 million for 1427r scenario.

6.2.2.9 Impacts on Aquaculture

Lack of specificity about response functions of springs to changes in surface water conditions prevents any quantitative estimate of potential economic impacts to Idaho's aquaculture industry at this time.

6.2.2.10 Summary of Agricultural Impacts

In both scenarios, changes in irrigated land use would exceed 5 percent. Five percent variations in irrigated crop land use have not been uncommon in the past, largely due to variations in Federal farm program set-aside requirements. The land use changes resulting from either scenario would be in addition to the underlying year-to-year variation.

If spread evenly over a very large area, land use changes of this magnitude would perhaps not be significant. However, actual implementation is likely to result in concentrated areas of fallowing. Irrigation water is distributed by open canals which need to be run near capacity in order to provide sufficient head to deliver water to the end of the canal. Partial use of canals is usually not feasible. Therefore, implementation of a large-scale water acquisition program might necessitate concentrated fallowing in areas served by some canals or on some reaches of canals.

Impacts directly associated with concentrated fallowing can include blowing dust, reduced groundwater recharge affecting wells, reduced surface return flow affecting riparian habitat, and nuisances (weeds and rodents) to lands remaining in production.

A category of impacts not included in this section is the effect of the scenarios on receipts and expenditures of cities, counties and states. To be able to analyze these fiscal impacts would require highly specific information on water sources and the method of obtaining the water source. That type of analysis is not possible with the present level of information. Attachment E provides more information on the possible methodology and some background information.

Total impacts on agricultural land, production, and revenue would be substantially greater in scenario 1427r than under 1427i. Direct economic effects would be similar in nature to those for the 1427i scenario, but could be larger in magnitude as a result of the greater amount of water acquired to meet the goals of the 1427r scenario. Figure 6-8 shows the magnitude of changes in the value of production using the three methods of crop reduction. While the least cost and modified proportional methods produce similar results, the strict proportional method results in a much greater estimate of the loss of production.

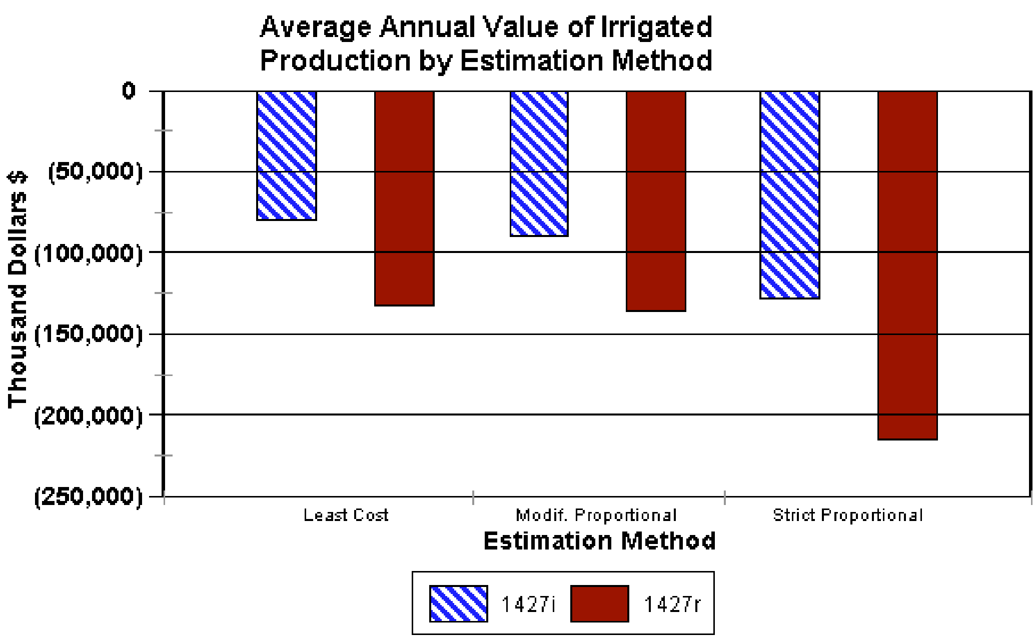


Figure 6-8 Comparison of 1427i and 1427r Scenario Effects on Value of Production by the Three Crop Reduction Methods

6.3 Hydropower

This section discusses existing hydropower generation capabilities and the effect of increased flow augmentation on hydropower generation, Federal irrigation pumping rates, and the economic value of power generation at 20 hydroelectric plants located on the main stem Snake, Boise, Payette, and Owyhee Rivers in the Snake River basin upstream of Brownlee Dam.

6.3.1 Methodology

The Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies (U.S. Water Resources Council, 1983) suggests a 100-year period of analysis. Consistent with that guideline, a 100-year period of analysis was used and composed of a 20-year price escalation period and an 80-year extension period in which prices are held constant. It was assumed that flow augmentation would be implemented in 2002. All estimates of economic costs and benefits were calculated in real 1998 dollars and the applicable Federal discount rate of 7.125 percent. A water year is defined as October 1 through September 30. Although the MODSIM hydrology modeling was for the 62-year period of 1928-1989, avoided costs (prices) were available only from 1929 through 1977. As a result, this economic analysis is based on the MODSIM output for the 49-year period of 1929-1977.

Power production figures were developed from MODSIM output by applying standard power equations using the power utility WRD212PB as developed by IDWR and modified by Reclamation.

The costs of constructing and operating a hydropower plant are typically determined by the size of the plant. Additional water can be released through the plant to produce peaking energy at very little added expense; therefore, the variable cost of operating a hydropower plant was assumed to be $0.00/megawatt-hour.

For consistency with the hydrologic modeling, this programmatic level economic analysis is based on a monthly time step. MODSIM results were used to simulate monthly hydropower generation data for 1929 through 1977 at 20 powerplants within the Snake River basin for the Base Case, 1427i, and 1427r scenarios. The hydrologic model results were used in the hydropower economic spreadsheet model which calculates the difference in generation between the Base Case and the 1427i and 1427r scenarios, powerplant change in generation by month, and total system change in generation. The economic value of the difference in generation from the Base Case was calculated by multiplying change in generation by the appropriate avoided costs of electricity. The data for simulated water years 1929-1977 were aggregated into three groups for reporting purposes: (1) all modeled hydropower plants, (2) non-Federal hydropower plants, and (3) Reclamation hydropower plants.

The avoided cost data used in this analysis were estimated using the Aurora model (a proprietary production-cost and market simulation model employed by the NPPC to investigate a number of scenarios relative to BPA's financial and economic well-being). The Aurora model estimates the hourly market clearing electricity price and the total cost of operating the Pacific Northwest power system. A detailed description of this model, the input data used, and a detailed treatment of fuel price assumptions can be found in (NPPC, 1998). Monthly avoided cost data for the mean price escalation assumption (real 1998 dollars) for each operational year from 2002 through 2021 for each augmentation scenario for water years 1929-1977 were used in this analysis (see attachment F). The present and annualized value in 2002 of hydropower effects were then calculated.

Avoided costs in this part of the country are typically higher in the fall and winter and lower in the spring and summer. Electricity prices are projected to remain relatively constant, or decrease, over the forecast period 2002-2021. These price trends largely reflect the fuel price assumptions used in the Aurora model.

The approach used in this analysis neither captures the potentially mitigating effects of excess capacity in the interconnected system, nor characterizes the effects, if any, of the1427i or 1427r scenario operational regimes on dependable capacity. As with any long-term study, the results reported here are sensitive to the underlying hydrologic assumptions and projections of long-run avoided costs (prices). This analysis does not capture the effects, if any, outside the Snake River basin or downstream of Brownlee Reservoir.

Since generation from Reclamation hydropower plants is used in part to provide pumping power for authorized projects, an analysis of the possible rate changes was made. The Southern Idaho Irrigation Pumping Rate (SIIPR) is set for a 5-year period and is a function of capital and operating costs and annual generation. The current 5-year period started in 1997 and runs through 2001. For this analysis, changes in the pumping rate were determined as a function of changes in generation and the cost of generation at five Reclamation powerplants: Anderson Ranch, Black Canyon, Minidoka, Palisades, and Boise River Diversion Dam. Although Boise River Diversion Dam powerplant has not been in operation in recent years, annual operation and maintenance costs at this facility remain assigned to power generation. The SIIPR was projected from the present (1998) through the end of the current 5-year period (2001) and the rate impact was determined.

6.3.2 Affected Environment

Hydroelectric powerplants make up approximately 10 percent of installed generation capacity nationally, compared with coal fired plants which make up about 40 percent. In the Pacific Northwest, hydropower plays a much larger role where it comprises about 68 percent of all generation capacity (Driver, 1998). Hydroelectric and other generation facilities in the Snake River basin upstream of Brownlee Reservoir are linked to other Pacific Northwest facilities through a system of interconnected electric power transmission lines. Operation of any generation unit affects, and are affected by, operations of the other interconnected units in the system.

The focus of this programmatic level analysis is larger hydropower facilities in the Snake River basin upstream of Brownlee Reservoir that are directly affected by changes in the operations of Federal reservoirs at which data is available. Changes in reservoir operations within the basin would result in changes in the timing and the quantity of electric energy generated by those powerplants which are hydrologically or directly affected by such changes. Changes in operations of these facilities would, in turn, indirectly affect the operations of other interconnected units in the system. However, estimation of these indirect effects is beyond the scope of this analysis.

Electricity cannot be efficiently stored on a large scale using currently available technology. It must be produced as the need arises. Consequently, when a change in demand (referred to as load) occurs, such as when an irrigation pump is turned on, the production of electricity must be increased somewhere in the interconnected power system to satisfy this demand. Load varies on a monthly, weekly, daily, and hourly basis. During the year, the aggregate demand for electricity is highest when heating and cooling needs, respectively, are greatest. During a given week, the demand for electricity is typically higher on weekdays, with less demand on weekends and particularly on holiday weekends. During a given day, the aggregate demand for electricity is relatively low from midnight through the early morning hours, rises sharply during working hours, and falls during the late evening. Electric energy is most valuable when the demand is highest (referred to as the on-peak period). In the West, the on-peak period is defined as the hours from 7:00 a.m. to 11:00 p.m., Monday through Saturday. All other hours are considered to be off-peak.

Capacity, the maximum amount of electricity that can be produced by a powerplant, is usually measured in megawatts. In contrast to thermal powerplants that have a fixed capacity, the capacity of hydropower plants is a function of reservoir elevation, the amount of water available for release, and the design of the facility. Because the capacity at hydropower plants varies, the amount of dependable or marketable capacity is of particular significance. Dependable or marketable capacity is determined using various probabilistic methods (Ouarda et al., 1997).

There are two principle types of hydropower plants, run-of-river and peaking. Run-of-river plants typically have little water storage capability and simply pass the river flow. Consequently, generation at these plants is proportional to water inflow and there is little variation in electrical output during the day. Peaking hydropower plants, such as Hells Canyon, have significant water storage capability and are designed to rapidly change output levels to satisfy changes in the demand for electricity. Peaking hydropower plants are particularly valuable because they can be used to generate power during on-peak periods, avoiding the cost of operating more expensive thermal plants such as gas turbine units. Another characteristic of hydroelectric powerplants is that they are more reliable than thermal plants and they do not generate airborne emissions.

6.3.2.1 Powerplants Included in the Analysis

There are 36 hydroelectric powerplants greater than 5 MW capacity located in the Snake River basin upstream of Brownlee Reservoir. Twenty-four of these would be directly affected by potential changes in the operations of Federal reservoirs. Available data allows 20 of the 24 potentially affected plants to be modeled for this analysis. These include four Reclamation powerplants with a combined capacity of 254.7 MW and 16 non-Federal hydropower plants with a combined capacity of 704.5 MW. The non-Federal plants include 11 IPC facilities with a combined capacity of 542.2 MW and 5 other facilities with a combined capacity of 162.3 MW. Data used in modeling the 20 powerplants is included attachment G.

Powerplant owners and nameplate capacities are summarized in table 6-20 which lists the powerplants in order from upstream to downstream.

Table 6-20 Modeled Hydropower Plants

Powerplant	Owner	Capacity (MW)
Palisades	Bureau of Reclamation	176.5
Idaho Falls	City of Idaho Falls	23.5
Gem State	City of Idaho Falls	24.0
American Falls	Idaho Power Company	112.4
Minidoka	Bureau of Reclamation	28.0
Milner	Idaho Power Company	57.5
Twin Falls	Idaho Power Company	52.1
Shoshone Falls	Idaho Power Company	12.5
Upper Salmon Falls A	Idaho Power Company	18.0
Upper Salmon Falls B	Idaho Power Company	19.5
Lower Salmon Falls	Idaho Power Company	60.0
Bliss	Idaho Power Company	80.0
C.J. Strike	Idaho Power Company	89.0
Swan Falls	Idaho Power Company	27.2

Table 6-20 Modeled Hydropower Plants		
Powerplant	Owner	Capacity (MW)
Anderson Ranch	Bureau of Reclamation	40.0
Lucky Peak	Four Boise Project Irrigation Districts	101.2
Cascade	Idaho Power Company	14.0
Black Canyon	Bureau of Reclamation	10.2
Owyhee	Owyhee Irrigation District	5.5
Owyhee Tunnel Outlet	Owyhee Irrigation District	8.1

These powerplants not only furnish capacity and energy, but also contribute greatly to system reliability through the Automatic Generation Control system that adjusts the generation, second by second, to match changes in load in the interconnected electrical power system. These powerplants provide extra energy during extreme hot or cold weather periods and help maintain transmission stability during system disturbances. The powerplants also fulfill part of the Western Systems Coordinating Council reserve requirements and provide backup generation in the event of unexpected outages.

6.3.2.2 Southern Idaho Irrigation Pumping Rate

Generation from Reclamation powerplants in the basin, in part, provides irrigation pumping power for certain irrigation districts within Reclamation projects in the basin: Minidoka, Boise, and Owyhee Projects. Approximately 25-30 percent of the annual generation from these powerplants is used for irrigation pumping. Generation that is surplus to project use is delivered to and marketed by BPA.

6.3.3 Environmental Consequences

6.3.3.1 National Economic Value of Hydropower

The economic value of operating an existing hydropower plant is measured by the avoided cost of doing so, or the difference between the cost of satisfying the demand for electricity with operation of the hydropower plant versus without operating the hydropower plant. Conceptually, avoided cost is the savings realized by supplying electricity from a low-cost hydropower source rather than a higher-cost thermal source. These savings arise because the variable cost of operating a hydropower plant is relatively low in comparison to thermal units. The variable costs of operating an average hydropower plant in 1995 was $5.89 per megawatt-hour. In contrast, the variable cost of operating the average fossil-fuel steam plant was $21.11 per megawatt-hour and the variable cost of operating the average gas turbine peaking unit was approximately $28.67 per megawatt-hour (Energy Information Administration, 1996).

The economic value of operating an existing hydropower plant varies considerably with time of day. The variable cost of meeting demand varies on an hourly basis, depending on the demand for electricity and the mix of plants being operated and their output levels. Base demand is typically satisfied with low-cost units, such as coal, run-of-river hydropower, and nuclear units that operate more or less continuously during off-peak periods. During on-peak periods, the additional load is met with sources that can be efficiently turned on and off and facilities that are progressively more expensive to operate. The economic value of hydropower is consequently greatest during the hours when the demand for electricity and the variable cost of meeting demand are highest. Hydropower plants associated with storage reservoirs are a valuable resource to meet peak demands.

If the variable cost of purchasing an additional megawatt of electricity from a least-cost source were observable in the market, the economic value of producing hydroelectricity could be readily determined. For example, assume that the cost of purchasing a megawatt of electricity from the least-cost source were $30.00 in a particular hour and the cost of producing a megawatt of hydroelectricity were $6.00. Then, the avoided cost or economic value of producing an additional megawatt of hydropower at that time would be ($30.00-$6.00) or $24.00.

Avoided cost data used in this analysis were estimated using the Aurora model as explained in the Methodology section.

6.3.3.2 Effects on Generation and Economic Value of Generation

The results obtained with the MODSIM hydrology model suggest that all four scenarios would result in about the same amount of annual generation. Table 6-21 summarizes annual generation for the selected 20 powerplants. Figure 6-9 displays the same information for all of the powerplants and just the four Reclamation plants.

Table 6-21 Average Annual Generation of the Selected 20 Powerplants (1929-1977) (Megawatt-Hours)				
Hydropower Plants	Base Case	No Augmentation	14127i	1427r
All Plants	4,745,253	4,748,269	4,649,455	4,827,067
Reclamation	1,131,400	1,165,200	1,073,100	1,151,700
Non-Federal	3,613,853	3,583,069	3,576,355	3,675,367

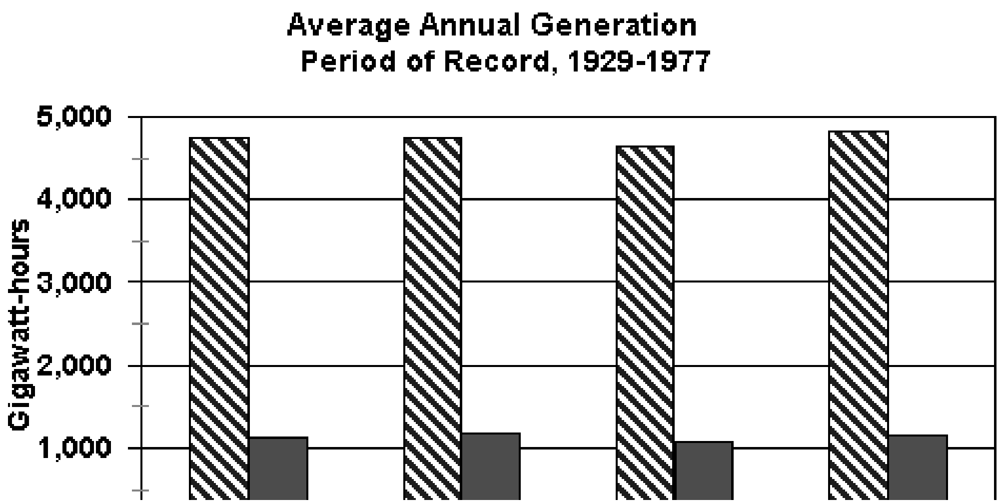


Figure 6-9 Average Annual Generation (Gigawatt-Hours)

Monthly generation changes are significant. Figures 6-1-, 6-11, and 6-12 illustrate the monthly percentage change in generation for the No Augmentation, 1427i, and 1427r scenarios respectively. Both positive and negative effects on hydropower generation would occur depending on the month.

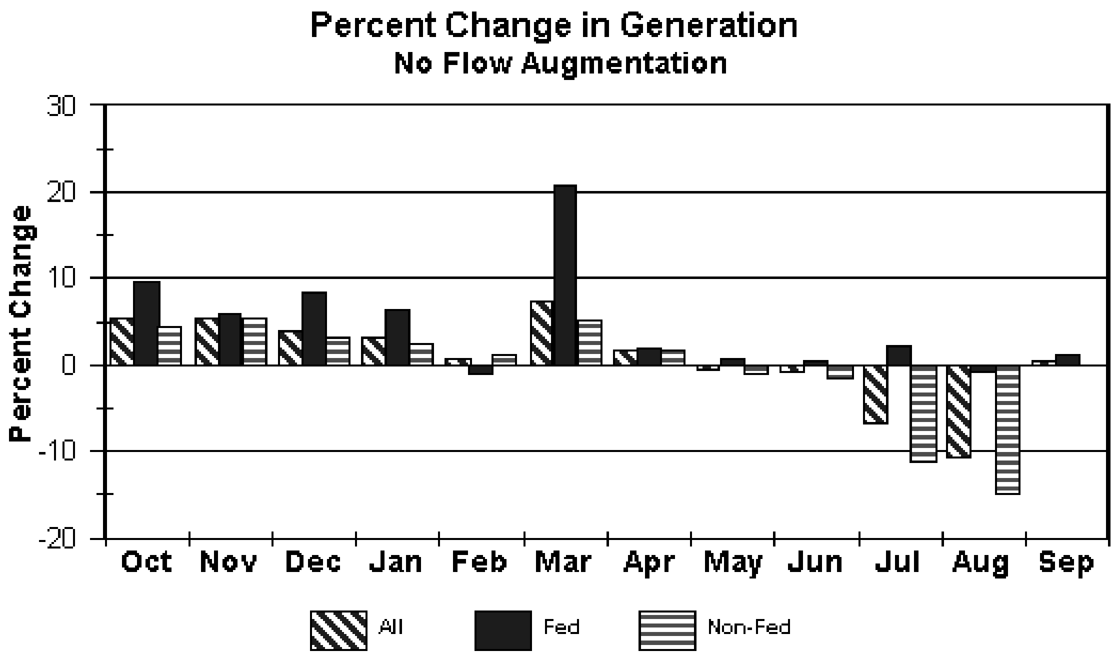


Figure 6-10 Monthly Percent Change in Generation for the No Augmentation Scenario

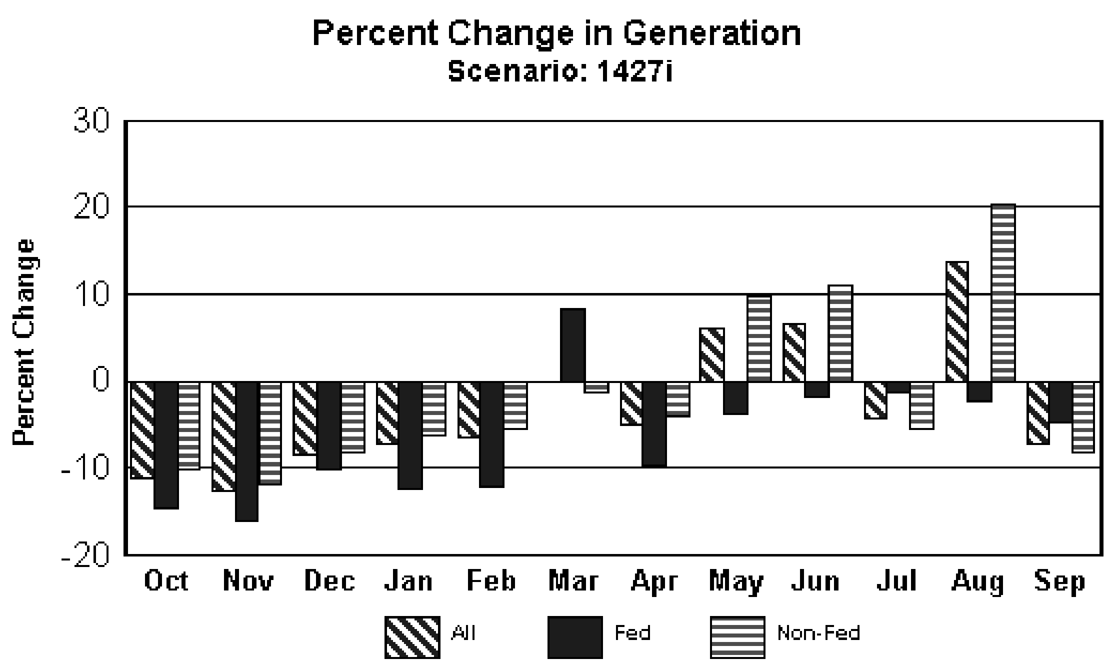


Figure 6-11 Monthly Percent Change in Generation of the 1427i Scenario

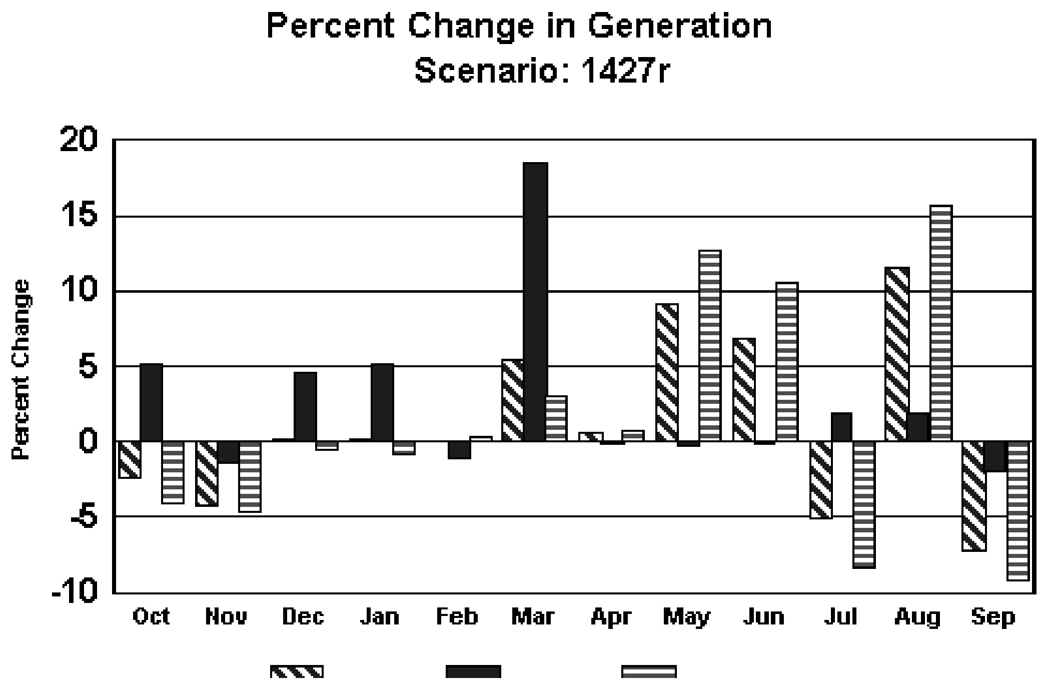


Figure 6-12 Monthly Percent Change in Generation of the 1427r Scenario

Relative to the Base Case, the total annual generation for the modeled plants would decrease by 95,798 MWh (a loss of 2.02 percent) for the 1427i scenario. The Federal facilities would generate less energy because Federal reservoirs would be drafted heavily to meet irrigation demands. Generation would decrease by 5.16 percent at Federal facilities and by approximately 1.04 percent at non-Federal facilities.

Relative to the base case, the total annual generation for the modeled plants would increase by 81,814 MWh (1.72 percent) for the 1427r scenario. Generation would increase by 1.8 percent at Federal facilities and approximately 1.7 percent at non-Federal facilities.

Table 6-22 illustrates the net present value of economic effects estimated for the 1427i and 1427r scenarios.

Table 6-22 Net Present Value in 2002 of Economic Hydropower Effects Relative to the Base Case (Real 1998 Dollars (7.125 Percent Discount Rate))

Hydropower Plants	1427i	1427r
All Plants	-38,078,000	25,301,000
Reclamation	-22,479,000	7,004,000
Non-Federal	-15,599,000	18,297,000

Lower reservoir levels of the 1427i scenario would reduce hydraulic head for powerplants. Consequently, less electricity would be generated for each acre-foot of water released. Additionally, more generation would occur during months when the value of the electricity is lower and less generation would occur during high value months. The net present economic value (at 7.125 percent) of the electricity produced at the 20 hydropower plants would fall by 2.31 percent under the 1427i scenario. The net economic value would decrease by 5.86 percent for Federal facilities and by 1.24 percent for non-Federal facilities.

Reservoirs would be maintained at higher levels during the summer with the 1427r scenario. As a result, the amount of head available for generation would be greater and more electricity would be generated for each acre-foot of water released. As shown in table 6-22, the net present economic value (at 7.125 percent) of the electricity generated by the 20 hydropower plants would rise by 1.6 percent. The net economic value would increase by 1.9 percent for Federal facilities and by 1.5 percent for non-Federal facilities.

Table 6-23 illustrates the change in annual equivalent value of the two scenarios. The annual equivalent value is the amount of money which, if received each year, would yield an amount equal to the net present value shown in table 6-19.

Table 6-23 Annual Equivalent Value in 2002 of Economic Hydropower Effects Relative to the Base Case (Real 1998 Dollars (7.125 Percent Discount Rate))

Hydropower Plant	1427i	1427r
All Plants	-2,716,000	1,876,000
Reclamation	-1,603,000	519,000
Non-Federal	-1,113,000	1,357,000

The 1427i and 1427r scenarios would affect the economic value of the electricity produced. Given the range of potential economic effects of these two scenarios, the tradeoff between hydropower production and other economic activities needs close scrutiny and must be carefully weighed by decisionmakers.

6.3.3.3 Effects on Southern Idaho Irrigation Pumping Rate

Generation at Reclamation powerplants was estimated for each scenario. Table 6-24 summarizes average annual generation and the change from the Base Case scenario for the four active Reclamation powerplants. The analysis indicates that annual generation would increase with the No Augmentation and 1427r scenarios and decrease with the 1427i scenario.

Table 6-24 Average Annual Generation At Four Reclamation Powerplants 1929-1977 (Thousand Megawatt-Hours)

Scenario	Anderson Ranch	Palisades	Minidoka	Black Canyon	Total	Total Change
Base Case	138.6	781.9	149.2	61.6	1,131.3	0.0
No Augmentation	142.4	797.5	150.6	74.6	1,165.1	33.8
1427i	140.7	726.2	129.6	76.5	1,073.0	- 58.3
1427r	146.2	796.1	132.4	77.1	1,151.8	20.5

Table 6-25 shows the projected SIIPR along with the percentage of change from the base case scenario for fiscal years 1998 through 2001.

Table 6-25 Southern Idaho Irrigation Pumping Rate and Percent Change From the Base Case (Mills

per Kilowatt-hour and Percent Change from the Base Case)							
Fiscal Year	Base Case	No Augmentation		1427i		1427r	
	Rate	Rate	Change (Percent)	Rate	Change (Percent)	Rate	Change (Percent)
1998	12.50	12.22	-2.2	13.03	4.2	12.33	-1.4
1999	12.51	12.22	-2.2	13.04	4.2	12.33	-1.4
2000	12.41	12.12	-2.3	12.93	4.2	12.23	-1.4
2001	12.70	12.41	-2.3	13.25	4.3	12.53	-1.3

The SIIPR, under the No Augmentation and 1427r scenarios would incur respective rate decreases of approximately 2.2 percent and 1.4 percent. The 1427i scenario would incur a rate increase of approximately 4.2 percent. Any policy decision that would change the annual generation at these plants would have the potential to influence the pumping rate.

6.4 Recreation

This section identifies economic impacts on recreation activities at 11 sites, representing both a geographic and recreational use cross section. These sites are: Jackson Lake, Palisades Reservoir, Snake River near Moran, Snake River near Irwin, American Falls Reservoir, Cascade Reservoir, Payette River at Horseshoe Bend, North Fork Payette River at Cascade, Lucky Peak Lake, Boise River downstream of Boise River Diversion Dam, and Lake Owyhee. These sites were selected as representative of the types of potential recreation economic impacts that might be expected under the flow augmentation scenarios.

Defendable, consistent recreation use information is not available for the entire Snake River basin; therefore, a comprehensive recreation economic impact analysis was beyond the scope of this analysis. The economic impacts identified in this analysis apply only to the 11 identified sites and do not represent the total magnitude of recreation economic impacts that may result throughout the entire basin from the flow augmentation scenarios. A more comprehensive analysis would likely reflect far greater recreation economic impacts than this analysis indicates.

If a flow augmentation proposal is seriously considered in the future, a more detailed and comprehensive analysis of the recreation economic impacts would be conducted prior to implementation.

Social effects related to recreation economic impacts are discussed in chapter 8.

6.4.1 Methodology

The preferred method for determining economic value for recreation is to conduct site-specific studies; however, this method was beyond the scope of this analysis. The method used in this flow augmentation analysis was use of other studies to estimate the economic benefits for various recreation activities by matching characteristics at sites in the Pacific Northwest where recreation economic studies have been done, with the 11 sites in the Snake River basin. This correlation or “benefits transfer” approach has been utilized in various other studies of recreation impacts. Impacts on recreation usage and the resulting economic values were measured as changes from the Base Case scenario. The change in recreation activity (such as boating, fishing, camping, etc.) resulting from limited access to facilities due to changes in operations at each of the 11 sites was multiplied by the value (benefit value per recreation day) for each activity. The resulting total change in annual economic value, or benefit loss, by activity was then computed for each recreation site and for each scenario. Benefit values are in 1998 dollars.

The change in recreation activity due to changes in river/reservoir operations under the 1427i and 1427r scenarios would, in reality, probably occur proportionately over time, coinciding with the acquisition of additional water for flow augmentation. However, the uncertainty associated with acquisition makes it difficult to identify an exact time frame for implementation. For this analysis, a 1-year implementation period was assumed. Accordingly, the economic estimates were computed at full implementation and were not presented as annual equivalent values to account for time of implementation.

Economic recreation impacts under the No Augmentation scenario were assumed to be similar to the Base Case scenario; therefore, no analysis of the no augmentation scenario was completed.

6.4.2 Affected Environment

Recreation activities and usage are discussed chapter 7.

6.4.3 Environmental Consequences and National Economic Value of Recreation

Changes in visitation and the factors affecting visitation are described in chapter 7. These changes were allocated among activities at each site and a value per day was applied to estimate the economic value. The monetary values for recreation user-day activities are shown in table 6-26. The average value for each activity was used for this analysis.

Table 6-26 Monetary Values of Recreation Activities (Average Net Economic Value per Household in 1998 Dollars)

Activity	McCollum et al.[1]	Walsh et al.[2]	Reclamation	Average
General recreation	7.18	NA		7.18
Sightseeing	13.15	28.76*		20.95
Camping	13.27	27.62		20.45
Fishing (cold water)	11.11	42.91		27.01
Fishing (trout)		98.49		98.49
Fishing (warm water)	15.95	41.36		28.65
Picnicking	11.72	12.72*		12.22
Nonmotorized Boating		69.00*	66.85	67.93
Motorized Boating		44.73*		44.73
Trails-hiking	40.01	41.22*		40.62
Swimming	12.98	32.56*	25.22*	23.58
Wildlife observation	12.91	42.18	39.89	31.66

[1]McCollum, D., G. Peterson, J. R. Arnold, D. Markstrom, D. Hellerstein. 1990. The Net Economic Value of Recreation on the National Forests: Twelve Types of Primary Activity Trips Across Nine Forest Service Regions. Rocky Mountain Forest and Range Experiment Station, Research Paper RM-289, U.S. Department of Agriculture. Ft. Collins, CO.
[2]Walsh, R. G., D. M. Johnson, and J. R. McKean. 1988. Review of Outdoor Recreation Demand Studies with Nonmarket Benefit Estimates, 1968-1988. Tech. Rep. 54, Colorado Water Resources Res. Inst., Colo. State Univ., Ft. Collins, CO.

6.4.3.1 1427i

Table 6-27 shows the effects of the 1427i scenario which results in a loss of about $13.7 million annually in benefits based on a loss of about 504,000 recreation-days. Tubing on the Boise River provides the single greatest negative impact with a loss of 126,000 visitor days. Other recreators would be greatly affected in aggregate, including motorboaters at Cascade Reservoir and Lucky Peak Lake, anglers at Lucky Peak Lake, and persons floating the Snake River below Moran, Wyoming.

Table 6-27 Change in Recreation Benefits with the 1427i Scenario				
Site	Visitation Loss (Visitor-Days)	Activity Affected	Distribution of Impacts (Percent)[1]	Reduction in Value (1998 Dollars)
Jackson Lake	1,500	Fishing, cold water	100	40,000
Palisades	6,700	Fishing, cold water	50	90,000
		Motorized boating	50	149,000
American Falls	43,000	Fishing, warm water	33	406,000
		Motorized boating	33	634,000
		Camping	33	290,000
Cascade	111,000	Fishing, cold water	8	226,000
		Fishing, warm water	23	718,000
		Motorized boating	33	166,100
		Camping	37	835,000
Lucky Peak	157,000	Fishing, warm water	40	180,500
		Motorized boating	40	2,817,000
		Swimming	10	371,000
		Picnicking	10	192,000
Owyhee	11,000	Fishing, warm water	40	126,000
		Camping	60	135,000
Snake River near Moran	17,000	Fishing, high quality/trophy	20	339,000
		Nonmotorized boating	80	936,000
River near Irwin	16,000	Fishing, high quality/trophy	20	319,000
		Camping	80	265,000
Boise River downstream of Diversion Dam	140,000	Fishing, cold water	10	378,000
		Tubing	90	905,000
NF Payette River at Cascade	300	Fishing, cold water	50	15,000
		Nonmotorized boating	50	10,000
Payette River at Horseshoe Bend	0			0
Total	504,000			13,664,000

[1]Distribution of impacts among activities affected, e.g., the only activity affected at Jackson Lake is fishing, so 100 percent of the impact is on fishing.

6.4.3.2 1427r

Table 6-28 shows the effects of the 1427r scenario on recreation which results in a loss of about $4.1 million annually in benefits based on a loss of about 212,000 recreation-days.. The largest impact is due to the loss of summer tubing on the Boise River with a loss of 129,600 visitor-days. While this activity has a low value relative to other activities, many participants will be affected due to changes in streamflows leading to a large total dollar value. On the Snake River near Moran, Wyoming, many persons float and fish this portion of the river who would be affected by changes in flow levels. The annual loss of about 5 percent of current visitation would lead to an annual loss in economic value of about $1.2 million.

Table 6-28 Reduction in Recreation Benefits with the 1427r Scenario

Site	Visitation Loss (Visitor-Days)	Activities	Distribution of Impacts (Percent)[1]	Reduction in Value (1998 Dollars)
Jackson Lake	0			0
Palisades Reservoir	0			0
American Falls Reservoir	15,000	Fishing, warm water	33	141,000
		Motorized boating	33	221,000
		Camping	33	101,000
Cascade Reservoir	30,000	Fishing, cold water	8	62,000
		Fishing, warm water	23	196,000
		Camping	37	228,000
		Motorized boating	33	453,000
Lucky Peak Lake	0			0
Lake Owyhee	7,000	Fishing, warm water	40	84,000
		Camping	60	90,000
Snake River near Moran	24,000	Fishing, high quality/trophy	20	311,000
		Nonmotorized boating	80	858,000
Snake River near Irwin	0			0
Boise River downstream of Diversion Dam	144,000	Fishing, cold water	10	389,000
		Tubing	90	931,000
NF Payette River at Cascade	100	Fishing, cold water	50	3,000
		Nonmotorized boating	50	2,000
Payette River at Horseshoe Bend	0			0
Total	212,000			4,069,000

[1]Distribution of impacts among activities affected, e.g., at American Falls Reservoir, three activities are equally affected so 33 percent of the impact is on each activity.

6.4.3.3 Summary

The 1427i and 1427r both result in the net loss of water based recreation activity in the basin. Because of the way the reservoirs would be operated, the loss of recreation under 1427r is less than under 1427i. The benefit loss is greater under 1427i because reservoirs would be drawn down to a great extent to meet flow augmentation demands. This results in lower end-of-month reservoir levels than under 1427r, and in some cases it also results in less desirable streamflows below reservoirs, both of which are less conducive for recreation activity.

The net annual economic loss in water-based recreation activity for the 11 sites was estimated at $13,664,000 million under 1427i and $4,069,000 under 1427r. Table 6-29 summarizes the annual loss in recreation benefits for the 11 sites by recreation activities.

Table 6-29 Annual Monetary Loss of Water Based Recreation (1998 Dollars)

Scenario	Activity				
	Boating & Rafting[1]	Camping and Picnicking	Fishing[2]	Other Water Activities[3]	Total
1427i	6,207,000	1,717,000	4,462,000	1,276,000	13,664,000
1427r	1,534,000	419,000	1,186,000	931,000	4,069,000

[1] Includes motorized and non-motorized boating, rafting, kayaking, and canoeing.
[2] Warm and cold water fishing.
[3] Includes swimming, tubing, and general recreation activities.

The figure 6-13 demonstrates the results graphically.

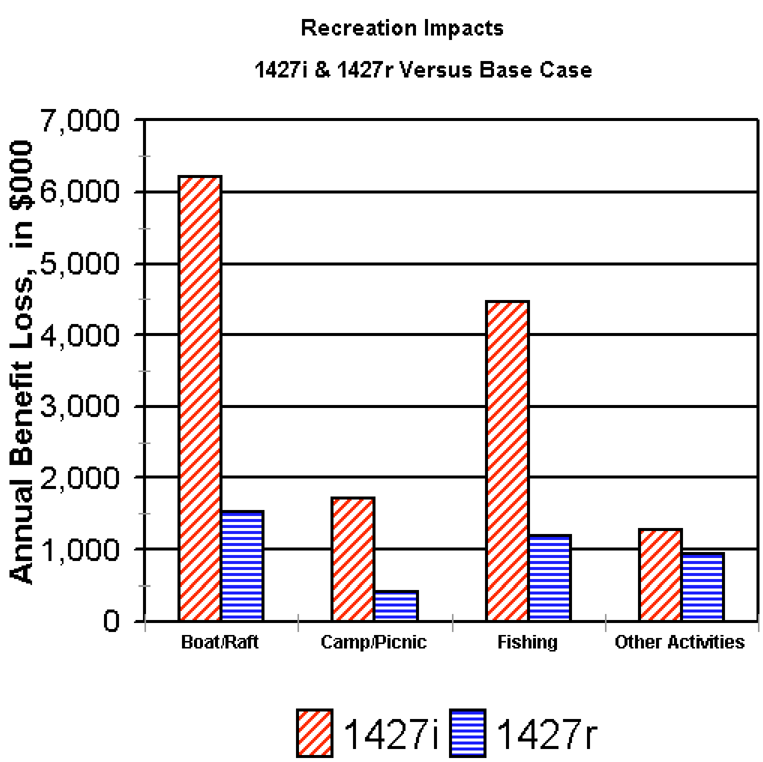


Figure 6-13 Annual Loss in Water-based Recreation (1998 Dollars)

6.5 Regional Economics

6.5.1 Regional Economic Areas

To facilitate regional economic analysis, the U.S. Department of Commerce, Bureau of Economic Analysis (BEA) has mapped principal trading regions into functional economic areas. These functional economic areas provide the geographic boundaries of somewhat self-contained regional economies. The main factor in determining regional boundaries are the labor commuting patterns within a region where goods and services are obtained. These economic areas are characterized by an urban central place and a surrounding rural periphery. After determining the geographic coverage of the four flow augmentation scenarios, four economic functional areas were mapped with the assistance of the BEA data. These four areas are shown in figure 6-2.

Regional economic model construction involves completing four regional input-output (I-O) models to represent the economy of the basin as shown in Figure 6-2. A set of IMPLAN accounts describe the baseline economy in each of the four regions and forms the basis for the regional economic models. These accounts describe the baseline economy in each region in terms of total sales, employment, and regional income and form the structure for the regional economic models that are the basis for subsequent economic impact studies. The analysis identifies agriculturally and recreation dependent sales, income and jobs throughout the economy that stem from the existence of irrigated agriculture and water based recreation. This work highlights the relative economic importance of irrigated agriculture in relation to the rest of the economy in the basin. The analysis also depicts the regional economic importance of water-based recreation found within these regional economic areas.

6.5.2 Benchmarking the Regional Input-Output Model

Special attention was given to assuring that the data in the regional input-output is in agreement with other sources of regional economic information. In particular, the IMPLAN data on agricultural output was adjusted to be consistent with value of production figures based on the Idaho Agricultural Statistics as compiled by the Idaho Agricultural Statistics Service. Crop yields and prices are the same as the estimates from Idaho Agricultural Statistics. The input-output accounts represent calendar year 1994.

6.5.3 Methodology

Regional I-O models are prepared to provide a detailed picture of a regional economy and predict the economic impacts of potential shocks to a regional economy. This study has chosen IMPLAN, an I-O modeling framework. I-O models are ordinarily used to estimate changes in employment and income brought on by changes in final demand. I-O analysis is based on the interdependence of production and consumption sectors in a regional area. Industries must purchase inputs from other industries for use in the production of outputs which are sold either to other industries or final consumers. Thus, a set of I-O accounts can be thought of as a picture of a region's economic structure. Flows of industrial inputs can be traced via the I-O accounts to show linkages between the industries composing the regional economy. The accounts are also transformed into a set of simultaneous equations that permit the estimation of economic impacts (changes in sales, employment, income, etc.) resulting from changes in sales to final demand. The model represents an economy where supply (sales) is assumed to respond to demand changes (final demand). I-O models are often described as demand driven models.

6.5.3.1 Irrigated Agriculture

To estimate the importance of irrigated agriculture to the region, both the forward and backward linkages associated with irrigated crop production in the region must be measured. Some industries such as fuel, machinery, and fertilizer in the region provide input to the irrigated crop sectors. These industries are commonly called backward linkages. Other industries in the region use irrigated crops as an input to their production process. These industries are often referred to as forward linked industries. An example of a forward linkage is a plant which processes potatoes. This is important to consider in a regional economy because without production of potatoes, the potato processing would diminish or disappear. Another example of forward linkage is a feed lot which buys input from local farms in the form of hay and grain.

Fortunately, there are several examples of how demand driven regional I-O models may be used to estimated the economy-wide impact of a reduction in the supply of some key natural resource. Petkovich and Ching (1978) used an I-O model to examine the impact of mining ore exhaustion in western Nevada; they used differing assumptions about the substitutability of imported replacement ore. Martin et al.(1998) used an I-O approach to model the impact of a reduction in agricultural supply stemming from the CRP in north central Oregon. Waters et al. (1994) used an inter-regional I-O model to examine the impact of supply reductions in logs from U.S. Forest Service land on the regional economies of western Oregon.

The methodology used to estimate the dependence of the forward linked industries is based on several assumptions. The first assumption is that loss of irrigated crops in a region cannot be replaced with imports. Without this assumption, import substitution would reduce the estimated impact of the forward linkage and the secondary impacts to the economy would be reduced. It is also assumed that there is no point were a plant would cease to operate because it cannot replace regionally produced irrigated inputs (threshold effect). With a threshold effect it is possible that selected forward linkage impacts would be larger than estimated in this analysis.

After the direct impacts are calculated for irrigated agriculture production (the value of irrigated crops in the region) and the forward linked industries, IMPLAN is used to calculate indirect and induced effects. Indirect effects are defined as the changes in inter-industry purchases by industries directly affected by changes in irrigated crop supply. Induced effects are the result of changes in spending by employees of industries directly and indirectly affected by changes in irrigated crop supply. Additional detail relating to the methods used to determine affected environment may be found in Engel and Holland (1998).

6.5.3.2 Recreation

The regional economic analysis of recreation impacts considers only those expenditures made by recreationists residing outside the functional economic area. Expenditures made by local residents are typically ignored under the assumption that local expenditures for recreation are considered as substitutes for expenditures on other goods and services within the functional economic area, i.e., a change in recreation opportunities would be reflected by an equal but opposite change for other regional goods and services. The net change in regional income and employment stemming from local residents would be zero. Another way of stating this is that there are no regional impacts resulting from changes in local expenditures for recreation. Expenditures by out of region recreationists are assumed to change with changes in recreation opportunities. The estimated change in recreation expenditures by out of region consumers drives the estimate of regional economic impact.

This analysis relies on knowledgeable recreation specialists to determine the percentage of resident and non-resident visitation. These percentages are applied to estimates of existing visitation (see chapter 7). Table 6-30 summarizes estimates of the percentage of non-resident visitation used in this analysis

Table 6-30 Recreation Visitation and Percent and Percent by Non-Residents

Economic Area	Recreation Focus Reach	Visitation	Percent Visitation by Non-Residents
Eastern Idaho–	Jackson Lake	298,000	90
Wyoming	Palisades Reservoir	62,000	25
	American Falls Reservoir	185,000	25
	Snake River near Irwin	428,000	75
	Snake River near Moran	281,500	75
South-Central Idaho	None	0	
Southwest Idaho--	Owyhee Reservoir	98,000	30
Oregon	Cascade Reservoir	450,000	25
	Lucky Peak Reservoir	787,260	5
	Boise River below Diversion Dam	350,000	3
	North Fork Payette River near Cascade	8,200	25
	Payette River near Horseshoe Bend	13,500	25
Eastern Oregon-Washington	None	0	
Total		2,961,460	

The next step was to determine recreator expenditures by activity. Expenditures are defined as daily expenses measured in dollars of a given activity. For example, the camping activity creates an average daily expenditure of $15.95 per day. For the purpose of this analysis, activities are summarized in four categories: fishing, water-based recreation, general day use, and camping. Limited data in the regional economic areas required the use of 1993 expenditure data estimated for outdoor recreation in Oregon (Johnson et al.,1995). These values were indexed to 1994 dollars, the base level used in this regional economic analysis. Table 6-31 summarizes expenditure by category of recreation used for this study.

Table 6-31 Recreation Activity Expenditures

Recreation Activity defined in IMPLAN	Activities Included	Expenditure per Visitor-Day	Eastern Area Total	Southwest Area Total
Camping	Camping	$15.95	$1,741,142	$583,132
Fishing	Warm-water fishing, cold-water fishing	$26.80	$4,722,495	$1,180,265
Water Based Recreation	Swimming, motorized and non-motorized boating, sailing, water skiing, tubing	$25.30	$7,690,884	$1,711,807
General Recreation	Picnicking, viewing	$37.08	$6,190,970	$3,900,071
Total			$20,345,491	$7,375,275

After expenditures by activity are determined, an expenditure profile for each activity is established. An expenditure profile separates the expenditures by type of expenditure, e.g., lodging, food, gas, etc. This is necessary as IMPLAN calculates sales, regional income and employment based on these expenditure profiles. This analysis uses expenditure profiles for camping, fishing, general recreation, and water based recreation developed by Johnson et al. (1995).

6.5.4 Affected Environment–Base Condition

The following sections describe the current regional economies of the four functional economic regions identified for the flow augmentation analysis.

6.5.4.1 Eastern Idaho-Wyoming Region

Agriculture is broadly defined to include livestock and crop production activities, agricultural services and food processing industries. Agricultural activities, so defined, rank second in sales and regional income to other activities in the Eastern region. Agriculture accounts for 15 percent of sales and 16 percent of regional income. Crop production and agricultural processing make up the largest portion of this broadly defined agricultural sector. Agriculture contributes approximately 12 percent of total regional employment which ranks it fourth in this region behind retail trade and the government sector.

These figures account for both forward and backward linkages that stem from irrigated agriculture. These estimates imply that if all irrigation were to cease in the region, the Eastern regional economy would lose 21,500 jobs and $942 million in regional income. Major sectors whose income is dependent on irrigated agriculture are the crop production sector (89 percent), agricultural processing (72 percent), agricultural services (50 percent), and livestock (22 percent). Roughly 16 percent of the transportation and wholesale industries income is dependent on irrigated agriculture. The service, communication, and retail industries have between 7 and 9 percent of their income tied to the existence of irrigated agriculture.

Recreation expenditures of approximately $20 million generate $16 million (0.15 percent of the regional economy) in sales, $7 million (0.13 percent) of regional income, and 321 jobs (0.19 percent of the regional economy). The majority of this activity is generated in the retail and service sectors.

The service sector contributes the largest amount to this region's economy in terms of employment, regional income, and sales. Service sector jobs account for 19 percent of sales, 27 percent of employment, and 22 percent of regional income. Tourism related activities comprise a large portion of the activity in this sector; this economic region includes Jackson, Wyoming and other popular tourist areas. Healthcare and business service related activities also make up a portion of this sector.

Other important sectors in the Eastern region economy include the government sector which contributes 17 percent of total employment and 13 percent of regional income. Government jobs and income stem from government purchases, transfers, and grants made to universities and government agencies as well as direct employment of labor by local, state, and Federal governments. The Idaho National Engineering and Environmental Laboratory (INEEL) and Idaho State University are major government employers in this region.
The retail sector accounts for 18 percent of the regions employment. These jobs and sales are generated in eating and drinking establishments, food stores, general merchandise establishments, auto dealerships, and building and garden supply stores.

6.5.4.2 South-Central Idaho Region

The agricultural sector contributes a greater amount of employment, regional income, and sales in the South-Central (Twin Falls) region than in any of the other three economic regions. Agriculture directly generates 24 percent of employment, 31 percent of regional income, and 32 percent of sales. Agricultural processing activities generate the largest portion of the jobs, income and sales. Livestock and crop production are also important, contributing respectively 6 and 11 percent of total regional income.

Irrigated agriculture generates about one-third of regional income and sales and about 22 percent of all jobs in the region. This amounts to 21,500 jobs and $937 million in regional income. Roughly 93 percent of crop production income comes from irrigated agriculture. About 74 percent of agricultural processing income is dependent on irrigated agriculture, and 33 percent of the transportation sector income and 35 percent of the wholesale trade is driven by irrigated agriculture. Roughly 14 percent of all retail trade and services income is generated by irrigated crop production.

The service sector ranks second in employment, income, and sales in the South-Central Idaho region. The service sector accounts for 19 percent of employment, 13 percent of regional income, and 11 percent of sales in this region. Retail trade is also an important contributor to employment in this region, making up 17 percent of employment. The Finance, Investment, and Real Estate (FIRE) sector contributes largely to sales and regional income in the region.

6.5.4.3 Southwest Idaho-Oregon Region

Agriculture plays a lesser role in the Southwest Idaho-Oregon (Boise) region which is dominated by the manufacturing, service, and government sectors in the Boise metropolitan area. The broadly defined agricultural sector contributes 10 percent of regional employment and 11 percent of regional income.

However, irrigated agriculture accounts for roughly 9 percent of regional income and 8 percent of regional employment. These estimates account for both forward and backward linkages that stem from irrigated agriculture. These estimates imply that if all irrigation were to stop in the region, the Southwest Idaho-Oregon regional economy would lose 22,100 jobs and $982 million in regional income. Major sectors whose income is dependent on irrigated agriculture are the crop production sector (96 percent), agricultural processing (62 percent) and livestock (24 percent). Roughly 9 percent of the transportation and wholesale industry incomes are dependent on irrigated agriculture. The service, communication, and retail industries have between 3 and 4 percent of their income tied to the existence of irrigated agriculture.

Approximately $7 million of recreation expenditures are generated in the Southwest region. These expenditures generate about $7.5 million of sales (0.03 percent of regional economy), $3.5 million of regional income (0.03 percent of regional economy), and 127 jobs (0.04 percent of regional economy). Like the Eastern region the activity occurs mainly in the retail sales and service industries.

Manufacturing makes up 24 percent of sales and 19 percent of regional income. The electronics industry make up a large portion of the manufacturing sector in this region. The government sector accounts for 22 percent of the region's economy. State government and Mountain Home Air Force Base generate a large portion of the government sector activities. The service sector generates 22 percent of employment and 14 percent of regional income.

6.5.4.4 Eastern Oregon-Washington Region

The broadly defined agricultural sector accounts for 25 percent of total sales, 19 percent of employment, and 22 percent of regional income, making it the largest contributor to sales and income in the Eastern Oregon-Washington region. About 11 percent of regional income comes from crop and livestock production with another 8 percent from agricultural processing. Data were not available to determine irrigated agriculture's contribution to this region's economy.

The service sector makes up the largest portion of regional employment at 20 percent but contributes only 14 percent of regional income. Government is a very important contributor to jobs and in this region accounting for 20 percent of total employment.

6.5.4.5 Summary of Base Case Regional Economy

Table 6-32 summarizes total sales, employment, and regional income of the four functional economic regions identified for this analysis.

Table 6-32 Summary of Base Case Regional Economies (1994 Dollars)

Region	Employment (Jobs)		Regional Income (Thousand Dollars)		Sales (Thousand Dollars)	
	Regional	Irrigated Agriculture	Regional	Irrigated Agriculture	Regional	Irrigated Agriculture
Eastern Idaho-Wyoming	172,381	21,519	5,870,546	941,869	11,275,215	1,691,392
South-Central Idaho	89,332	21,581	3,015,552	936,910	6,544,256	2,121,644
Southwest Idaho-Oregon	293,105	22,146	10,832,523	982,297	21,835,164	2,052,953
Eastern Oregon-Washington	103,725	([1])	3,591,402	([1])	7,122,877	([1])
Total	658,543		23,310,023		46,777,512	

[1]Data insufficient to determine contribution of irrigated agriculture

6.5.5 Environmental Consequences

The regional analysis of agricultural impacts measures the change in regional sales, employment, and income. The regional economic impacts include the direct and secondary effects stemming from lost irrigated agricultural production. Secondary effects are usually separated into (1) indirect effects that would stem from industries supplying inputs to the agricultural production process and (2) induced effects that result from changes in payrolls and subsequent changes in household consumption.

Three alternative estimates of regional impacts were made based on the following:

- Reduced Irrigation. This estimate is of impacts stemming from the reduction in irrigated agricultural production only.

- Reduced Irrigation With Payments to Farmers. This estimate adds the impacts of a hypothetical water acquisition program to those of a reduction in irrigated agriculture production.

- Reduced Irrigation With Forward Linkages. This estimate adds the effect of forward linkages to those of a reduction in irrigated agriculture production. That is, it adds the ripple effects to industries such as livestock and agricultural processing that use irrigated crops as a part of their production process.

Reclamation considers that the second estimate–Reduced Irrigated Agriculture Production With Water Payments–would be the best estimate of likely regional economic impacts. The third estimate–Reduced Irrigated Agricultural Production With Forward Linkage–would shows the largest regional economic impact and represents the upper end of the possible range of economic impacts based on the water sources evaluated.

6.5.5.1 Impacts from Reduced Irrigation

This estimate focuses on direct and secondary impacts that would stem from the reduction in irrigated agricultural production under the 1427i and 1427r scenarios. The analysis assumes that agriculture and its input suppliers are affected from reduced production of the specified irrigated crops. Industries supplying input to the agricultural production process are part of the indirect effects. Changes in payrolls and subsequent changes in household consumption are included in the induced effects. The regional economic impact is based on the total of direct effects and secondary effects without consideration of forward linkages or possible payments to farmers. Potential impacts are shown in table 6-33.

Table 6-33 Potential Losses from Reduced Irrigation

Region	1427i			1427r		
	Employment	Income	Sales	Employment	Income	Sales
Eastern Idaho-Wyoming	920 jobs	$26,300,000	$38,400,000	923 jobs	$26,600,000	$30,000,000
South-Central Idaho	388 jobs	$11,000,000	$20,000,000	1,120 jobs	$31,600,000	$57,800,000
Southwest Idaho-Oregon	890 jobs	$22,000,000	$31,600,000	1,500 jobs	$37,000,000	$53,500,000
Eastern Oregon-Wyoming	660 jobs	$17,000,000	$23,500,000	660 jobs	$17,000,000	$23,500,000
Total	2,859 jobs	$76,300,000	$113,500,000	4,203 jobs	$112,200,000	$164,800,000

6.5.5.2 Impacts of Reduced Irrigation With Payments to Farmers

This estimate includes the impacts estimated for Reduced Irrigation (see section 6.5.5.1) along with the effect of payment to farmers for acquisition of water for the 1427i and 1427r scenarios. The value of the water payment to farmers was estimated at $75 per acre-foot of water consumed; this is the midpoint of acquisition costs based on recent water acquisitions and reduction in consumptive use (see section 6.2.2.7.1). Estimates using this method result in the lowest acquisition costs of the three estimating methods. The water acquisition payment is assumed to be made to farm households selling the water and is treated as household income.

Farm households tend to be elderly with strong regional and community ties therefore this analysis assumes that the income payment accrues to farm households in the region. However, it should also be noted that much of that income would not be spent on regionally produced goods and services. In order to estimate regional consumption generated by the income payment, it is necessary to estimate the leakage of that income to household savings and to Federal and state income taxes.

The IMPLAN Social Accounting Matrix for each of the four regions was used to estimate the rate of household savings and Federal and state income tax payments. The average saving and tax rates from the regional Social Account Matrix assumed to apply to the marginal change in household income represented by the income payment. Disposable household income is determined as the net after household saving and Federal and state income tax payments.

For this analysis, the pattern of household consumption in each regional input-output model is used to determine the consumption bundle and household expenditure. It is assumed that the marginal change in income results in the same pattern of regional household consumption as reflected in regional average consumption function in the input-output model. With this information, the mix of household consumption of goods and services is estimated. The proportion of regional consumption coming from regional production versus imported from outside the region is determined by using the regional purchase coefficient from the regional input-output model. In other words, some of the household consumption comes from regional production while some of the consumption is based on goods and services imported from outside the region. These commodities may be produced in other parts of the state, other states, or other countries. Only goods and services produced in the region have a ripple effects on the regional economy in terms of induced effects.

In summary, the direct effect of household spending of payments for water purchased is determined after accounting for leakage for imported consumption, household saving, and household Federal and state income tax payments. This direct effect of household spending of the income payment drives the induced effect of the income payment. The total regional impact of the Federal income payment to households is the sum of the estimated direct and induced effects of the associated regional household consumption. In this analysis, the income payment effects have been added to the irrigation loss effects. The result is the net loss in regional activity due to the reduction in irrigation. Potential impacts are shown in table 6-34.

Table 6-34 Potential Losses from Reduced Irrigation with Payment to Farmers

Item	1427i			1427r		
	Employment	Income	Sales	Employment	Income	Sales
Eastern Idaho-Wyoming	800 jobs	$12,000,000	$31,600,000	804 jobs	$12,900,000	$23,500,000
South-Central Idaho	323 jobs	$4,400,000	$16,400,000	873 jobs	$6,900,000	$44,300,000
Southwest Idaho-Oregon	800 jobs	$12,300,000	$26,200,000	1,315 jobs	$16,176,000	$41,600,000
Eastern Oregon-Washington	620 jobs	$16,000,000	$21,000,000	620 jobs	$16,000,000	$21,000,000
Total	2,543 jobs	$44,700,000	$95,200,000	3,612 jobs	$51,976,000	$130,400,000

6.5.5.3 Impacts of Reduced Irrigation With Forward Linkages

This estimate includes the impacts estimated for Reduced Irrigation (see section 6.5.5.1) along with the effect of forward linkages (see section 6.5.3.1).

If a reduction in crop production would result in a corresponding reduction in output of those industries using the crop as an input to their production process, then it is proper to include forward linkages as a part of a regional impact. The strength of the forward linkage between a crop and a given processing industry depends on the crop geographic specialization, the supply of the crop compared with regional demand, and the possibilities for importing a substitute input crop. When the crop is very specialized and there are no importable substitutes, forward linkages are more likely.

There are several reasons for believing that there will be little forward linkage impacts in the 1427i and 1427r scenarios. The crops that would be reduced are lower valued crops that exist in excess supply in each of the economic areas. Further, the estimates in this analysis indicate that the reduction of those crops under the 1427i and 1427r scenarios would be small compared to the total regional supply of affected crops. This means that an adequate supply of crops would continue to exist under the 1427i and 1427r scenarios. In addition, the crops that are most likely to be reduced are not highly specific to the economic regions considered in this analysis and alternative sources of these crops are likely available from other regions.

However, the issue of forward linkage as it applies to this analysis is controversial. Representatives of the water users have expressed the view that the effect of forward linkages might be magnified by a reduction in crop production due to the 1427i and 1427r scenarios. They contend that at least some forward linked plants operate on the economic margin and only a slight disruption in supply could entice the owners of such plants to relocate. They also contend that just the uncertainty that would be introduced by a decision to adopt a 1,427,000-acre-foot flow augmentation could be sufficient cause for processors to relocate facilities outside the region. However, there is also a possibility that 1,427,000 acre-feet could be provided without disrupting the water supply to high value crops like potatoes, but that the water supply to potato processors in the basin might be disrupted for a variety of reasons including additional flow augmentation.

Arguments for and against inclusion of forward linkages have a solid basis. The models suggest that there should continue to be sufficient supply of key agricultural crops. However, it is recognized that agriculture dependent economies are highly competitive, in a constant state of change and adjustment, and seemingly small changes can tip the economic balance in a different direction. Rather than judge between the two views, an estimate that adds forward linkages was made. Potential impacts are shown in table 6-35.

Table 6-35 Potential Losses from Reduced Irrigation with Forward Linkages						
Item	1427i			1427r		
	Employment	Income	Sales	Employment	Income	Sales
Eastern Idaho-Wyoming	1,200 jobs	$38,500,000	$67,700,000	1,130 jobs	$36,000,000	$63,000,000
South-Central Idaho	700 jobs	$24,000,000	$58,000,000	2,000 jobs	$67,600,000	$164,000,000
Southwest Idaho-Oregon	1,500 jobs	$48,000,000	$96,000,000	2,500 jobs	$83,800,000	$167,500,000
Eastern Oregon-Washington	900 jobs	$22,500,000	$37,000,000	900 jobs	$22,500,000	$37,000,000
Total	4,300 jobs	$133,000,000	$258,700,000	6,530 jobs	$209,900,000	$431,500,000

6.5.5.4 Impacts of Reduced Recreation

Recreation visits would be reduced in the Eastern and Southwest regions under the 1427i and 1427r scenarios. Reductions in non-resident spending associated with recreation would result in direct and secondary impacts to the regions. Table 6-36 summarizes lost expenditures by activity for each region.

Table 6-36 Lost Recreation Visitation and Associated Expenditures					
Activity	Expenditure per Visit	1427i Losses		1427r Losses	
		Visits	Expenditure	Visits	Expenditure
Eastern Region					
Camping	$15.95	13,148	$209,703	1,238	$19,738
Fishing	$26.80	10,685	$286,358	3,638	$97,485
Water-based recreation	$25.30	14,585	$369,001	10,838	$274,189
Total		38,418	$865,062	15,714	$391,412
Southwest Region					
Camping	$15.95	12,248	$195,348	4,035	$64,358
Fishing	$26.80	13,520	$362,336	3,610	$96,735
Water-based recreation	$25.30	16,900	$427,570	6,376	$161,300
General day use	$37.08	785	$29,108	0	
Total		43,453	$1,014,362	14,021	$322,393

6.5.5.4.1 Eastern Region

Lost expenditures for the 1427i scenario would be $865,000. With this level of impact, 14 jobs (0.008 percent of the regional economy), $315,000 of regional income (0.005 percent of the regional economy), and $684,000 in sales (0.006 percent of the regional economy) would be lost. These losses are very small relative to the total Eastern region economy.

Lost expenditures for the 1427r scenario is about $391,000. Six jobs (0.004 percent of the regional economy), $148,000 of regional income (0.003 percent of the regional economy), and $326,000 of sales (0.003 percent of the regional economy) would be associated with this level of impact.

6.5.5.4.2 Southwest Region

Lost expenditures for the 1427i scenario would be $1 million. With this level of impact, 19 jobs (0.007 percent of the regional economy), $509,000 in regional income (0.005 percent of the regional economy), and $1 million in regional sales (0.005 percent of the regional economy) would be lost.

Lost expenditures for the 1427r scenario would be $322,000. Six jobs (0.002 percent of the regional economy), $163,000 of regional income (0.001 percent of the regional economy), and $335,000 of sales (0.002 percent of the regional economy) would be lost.